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ABSTRACT

This manual on occupational analysis, developed in Australia, is organized in three sections. The first section provides a framework for occupational analysis (OA) and a discussion of possible outputs from an OA from each of three phases: (1) determining the nature and scope of the occupational area; (2) developing a competencies list; and (3) collecting data on each competency. Section 2 provides a set of flowcharts and discussion to assist selection of appropriate OA techniques for each step of the three phases. The third section discusses OA techniques. This section is in two parts: (1) a categorization of OA techniques (desk methods, field methods, inventory methods, introspection, and indirect methods); and (2) descriptions of selected OA techniques--information search, extended information search, observation, observation plus interview, interviewed individuals, competencies interview, DACUM (Developing a Curriculum), nominal group technique, and critical incident technique. A glossary, 19 references, and an index are included. (KC)

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CENTRE FOR RESEARCH IN EDUCATION AND WORK

Graham D. Hermann

MANUAL ON OCCUPATIONAL ANALYSIS

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MANUAL ON OCCUPATIONAL ANALYSIS

Graham D. Hermann
School of Education
Macquarie University
NSW 2109

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G. HERMANN

Centre for Research in Education and Work
School of Education
Macquarie University
Sydney, Australia

1989

FOREWORD

This is a revised version of the trial edition of the Manual on Occupational Analysis.

It is planned to revise this Manual as information on its use becomes available. I would welcome reports and collections of OA data obtained using the methods described in this Manual; suggestions on how the techniques and their descriptions can be improved would be greatly appreciated. Data on the comparison of two or more OA techniques would be especially useful. I would also welcome any other comments on how this Manual could be improved.

I would like to thank Audrey Wylie and Di Jones for the excellent word-processing involved in producing this Manual.

Graham D. Hermann
School of Education
Macquarie University NSW 2109
AUSTRALIA.

1989

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In developing education/training for workers in a specified occupational area, there is a need to determine precisely what the workers do - a need to undertake an occupational analysis (OA).	
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An occupational analysis may have three phases:	
1 - Describing the nature and scope of the occupational area (the general parameters)	4
2 - Developing a list of occupational competencies - what the person has to be able to do on the job	5
3 - Collecting data on each competency (such as importance, and frequency of performance). Such data are especially useful for determining the priorities among occupational competencies.	7
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B. FLOWCHARTS OF DECISION POINTS IN SELECTING OA TECHNIQUES	12
Many techniques have been developed for undertaking an occupational analysis (see Section C). The flowcharts can be used to guide the selection of specific OA techniques to meet specific needs and conditions. The key to this manual is the flowchart displaying the three phases of occupational analysis (page 14).	
The three phases of occupational analysis	14
Phase 1: Nature and scope of occupational area	15
This phase is needed to determine the scope (boundaries), branches (whether there are subsets/competency clusters within the occupational area), and context of the occupational area.	
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Care must be undertaken to obtain all competencies, including those sometimes difficult to detect (termed 'refractory') such as diagnostic and planning competencies.	
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SUGGESTIONS ON USING THIS MANUAL

PREPARING FOR THE OA (OCCUPATIONAL ANALYSIS)

1. Read pages 1 to 3, in order to comprehend the procedure of OA, and its relationship to other aspects of program development. Refer to the Glossary as necessary.

2. Read pages 4 to 10, and 14 to comprehend the 3 phases of OA. **Special attention should be given to differentiating the objectives of each phase, and to comprehending the sequential nature of the procedure** (as illustrated on page 14).

UNDERTAKING THE OA

3. Prepare for Phase 1 (Nature and scope of occupational area), by reading about Phase 1 on pages 4, and 14 to 20, in order to determine:

   a) the objectives for this phase of your OA

   b) the procedures and OA technique(s) appropriate for your circumstances (Refer to Section C, for information on specific OA techniques).

4. Prepare for Phase 2 (Developing a competencies list), by reading about Phase 2 on pages 5 to 7, 14, and 21 to 27, in order to determine:

   a) the objectives for this phase of your OA

   b) the procedures and OA technique(s) appropriate for your circumstances (Refer to Section C, for information on specific OA techniques).

   It is useful to display the competencies as a profile, composed of General Areas of Competence and related specific competencies (see Diagram 3, page 57).

5. If there is a need to undertake Phase 3 (Collecting data on each competency), prepare by reading about Phase 3 on pages 7 to 11 and 28 to 33, in order to determine:

   a) the objectives for this phase of your OA

   b) the procedures and OA technique(s) appropriate for your circumstances (Refer to Section C, for information on specific OA techniques).

6. Develop an integrated plan for your occupational analysis. It is necessary to ensure that the sample of respondents (e.g. people observed, interviewed, or whatever) is representative of the occupational area. (This is discussed in Step 1.2, Section B).

7. Undertake the procedures listed in the plan.

SECTION A

INTRODUCTION

This section provides

- A framework for occupational analysis (OA)
- A discussion of possible outputs from an OA from each phase:

Phase 1 - Determining the nature and scope of the occupational area

Phase 2 - Developing a competencies list

Phase 3 - Collecting data on each competency

A set of flowcharts to assist the selection of appropriate OA techniques for each phase is presented as Section B.

A discussion of OA techniques is presented in Section C.

A. INTRODUCTION

It is easy to say that an occupational course must meet the needs of industry.

However, such occupational information is frequently not readily available for local industry. There are a number of factors possibly involved:

- many industry spokespersons know their own enterprise, but have only limited knowledge of other enterprises in their industry sector.
- most industry spokespersons have been promoted away from the jobs performed by many workers in the enterprise, and may not be up-to-date concerning the detailed competencies needed for many jobs.
- assessing the occupational needs of industry can be a complex task.

(As indicated in the glossary, industry is used here to refer to all enterprises, including government and commerce.)

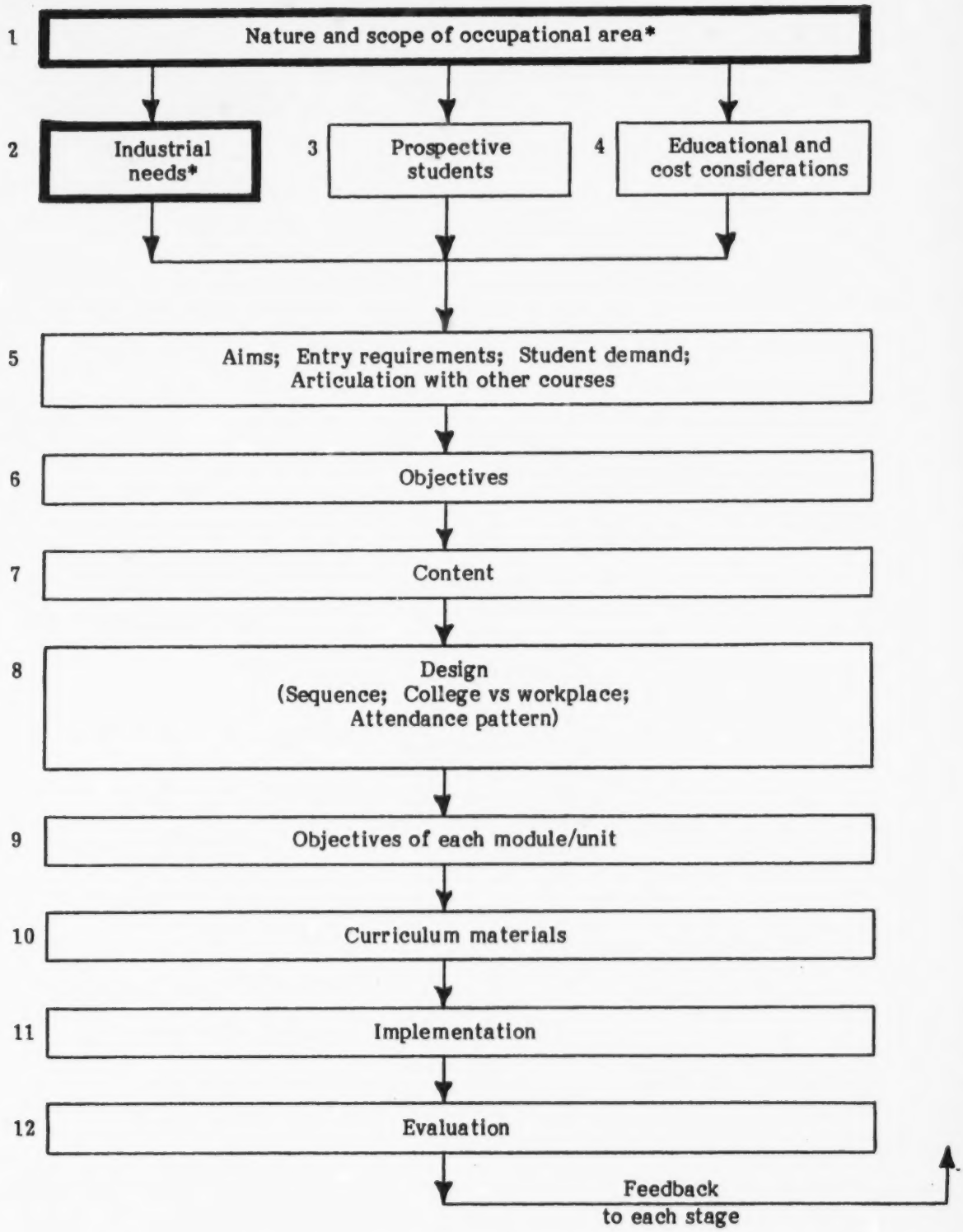
An **occupational analysis** is designed to obtain occupational data which are useful to developers of an occupational course.

The term **occupational area** is used in this manual to refer to the scope of the occupational analysis (OA); an occupational area could range across a number of related occupations, or could be restricted to a small part of an occupation. An OA could seek to determine all the competencies of 'initial customer contact persons' involved in the hospitality and travel industry sectors, or could seek to determine the communication competencies of automotive mechanics.

Obviously, a major step of an OA is to clearly specify the **scope** of the occupational area. (This is discussed as one step of Phase 1).

In planning the OA, subsequent decisions are made with respect to how the data will be used in course development. Referring to Diagram 1, OA data are especially important for Stages 1 and 2. In addition, OA data may be useful for Stages 5 to 9, depending on the data collected. If OA data are desired to assist in a specific task, such as designing course sequence, or in determining whether a nominated competency should be taught in an institution, or in-plant off-the-job, or in-plant on-the-job, the need to collect relevant data must be considered in planning the OA.

Diagram 1: OCCUPATIONAL PROGRAM DEVELOPMENT: OUTLINE OF STAGES


1 Nature and scope of occupational area*
2 Industrial needs*
3 Prospective students
4 Educational and cost considerations
5 Aims; Entry requirements; Student demand; Articulation with other courses
6 Objectives
7 Content
8 Design (Sequence; College vs workplace; Attendance pattern)
9 Objectives of each module/unit
10 Curriculum materials
11 Implementation
12 Evaluation
Feedback to each stage

* This manual relates specifically to these stages

Possible outputs from an OA

OCCUPATIONAL ANALYSIS

The rationale for an occupational course is that inter alia it meets the needs of industry, with respect to education/training for one or more specified occupations, or for a subset of an occupation.

An occupational analysis (OA) is used to determine such needs. An OA aims to provide data able to be used by course developers, and may produce the following:

Step 1.1 a statement of the nature and scope of an occupational area;

Step 2.1 a list of tasks/skills/competencies* presently performed by persons in an occupational area;

Step 2.2 a list of tasks/skills/competencies* which could be performed by persons in an occupational area in the near future;

Step 3.2 data concerning the performance of each task/skill/competency*;

Step 3.3 a clustering of tasks/skills/competencies* (so that distinct clusters can form the basis for separate courses, or for a course core plus a number of electives).

*Includes performances demonstrating cognitive capabilities, knowledge, psychomotor skills and/or an attitude.

An occupational analysis may be considered as one aspect of a needs analysis.

Examples of outputs from each phase

Phase 1: Determining the nature and scope of the occupational area

The essential outcome of Phase 1 is the scope (description) of the occupational area.

Scope (boundaries) of the occupational area: This is presented as a written description ready for Phase 2. This description consists of : Primary distinguishing functions; Other key descriptors (as needed); and Roles/Functions excluded. For example: Brief description of 'initial customer contact person':

> The person whose primary function is to initially receive guests/clients, assess their needs, and undertake relevant activities to address their needs. The title does not include management or supervision functions. (E.g. receptionist).

A second example is from the occupational area of secondary school teaching:

> The person whose primary function is to teach high school students. This involves presenting subject matter (such as mathematics, or economics, or a language). It excludes management and employee supervision functions (as performed by principals, deputy principals, and subject master/mistress), and excludes specialist functions (such as those performed by school librarians, counsellors, and careers advisors).

Developing a precise description of the occupational area is the key to a successful OA. It is vital that the occupational area is clearly distinguished from related occupational areas. It has been found that failure to adequately describe the occupational area results in many problems in Phases 2 and 3.

Unless there are good reasons, it is usually necessary to collect data on the context and branches of the occupational area.

Context: A major objective is to seek to identify possible changes in the occupational area. For example:

> It is expected that the occupation of typist will become less specialised as multiskilling increases, and that in addition to wordprocessing, typing will become one of a cluster of skills which include most clerical activities (filing, accounts clerk, etc.).

Branches (subsets, strata, competency clusters) **within the occupational area:** This task is undertaken in order to, at a later step, be able to check the variation of competencies across the branches of the occupational area. This task also provides data for the development of a sampling framework of respondents. For example:

> Branches of psychology include child counselling, occupational psychology, and psychological measurement.

Phase 2: Developing a competencies list

The objective of this phase is to produce a list of competencies (performances/capabilities) that are presently performed and/or may be performed in the near future. Such a list should probe for cognitive (knowledge and thinking), affective (attitudinal), and psychomotor competencies.

A competency describes a performance : what the job incumbent needs to be able to do. Therefore, **all competencies have a verb** : weigh, heat, inspect, test, diagnose, repair, etc. Virtually all competencies have an object. Competencies often have an expected outcome, such as information to be supplied by the job incumbent, unless the meaning of the competency statement is perfectly clear if it is omitted. Some examples of competency statements are:

Verb(s)	Object	Expected output
Advise	customers	of safety requirements
Prepare	eggs	for binding and coating
Inspect	building	for safety hazards
Fry	meats	
Select and use	wrenches	
Clean and adjust	humidifier	
Operate	smoke tester	

Increasing detail is added until there is agreement by persons knowledgeable in the occupation that there is no ambiguity about the meaning of a competency statement. Additional details could include:

- equipment, work aids, processes
- conditions under which competency is to be performed
- criteria for successful performance.

There are often some 100 competencies listed for one occupational area. To simplify discussion, and the development of a learning program, competencies are generally grouped together. Each group is generally given a title, often known as the General Area of Competence.

Often there are some 8 to 12 General Areas of Competence, with some 5 to 12 competencies in each General Area of Competence.

Example 1 : Pharmacy assistant (Extract from competency profile)

General Areas of Competence	Competencies		
SERVE CUSTOMERS	Operate cash register	Wrap product	etc.
DEMONSTRATE PRODUCT KNOWLEDGE	Inform customers of similar products	Identify product sizes and strengths	etc.
COMMUNICATE EFFECTIVELY; MAINTAIN GOOD CUSTOMER RELATIONS	Clarify and interpret the needs of the customer	Control children in shop	etc.
MANAGE STOCK	Monitor stock on shelves	Order new stock	etc.

Etc.

Example 2 : Secondary school teaching
(Extract from competency profile;
Willett and Hermann, 1989)

General Areas of Competence	Competencies
PREPARE PROGRAM & LESSONS	. Assess student readiness . Study lesson content . Prepare objectives . Sequence lesson activities . Check equipment . Anticipate problems etc.
IMPLEMENT PROGRAM & LESSONS	. Give clear instructions . Provide feedback to students; check for understanding . Motivate students . Use examples in explaining content . Ensure students apply learning . Present material clearly etc.
MANAGE AND COMMUNICATE WITH STUDENTS EFFECTIVELY	. Demonstrate consistency and fairness in discipline . Establish rapport and mutual respect with students . Be approachable, and listen to students . Provide a code of behaviour to students . Remember and pronounce student names correctly etc.
ETC.	

Phase 3: Collecting data on each competency

If the time allocated to the off-the-job education/training program is sufficient to teach all the competencies to the specified performance levels, then there may be no need to undertake Phase 3. This third phase is especially important **if a priority listing of competencies is needed** (in order to determine which should be included in the college and/or in-plant off-the-job program).

For example. One or more of the following categories of data can be collected for each competency:

- Extent of performance of each competency
- Importance of each competency
- Difficulty in learning each competency

Etc.

Rayner and Hermann (1988) describe an OA into the communication competencies of automotive mecnanics apprentices and young tradespersons. Results include:

(a) Frequency data

Ask questions for understanding	52 times
Explain to foreman	32 times
Explain to co-worker	19 times
Write out job card	8 times
Read catalogue	3 times

(b) Percentage time spent data

Describe work done on vehicle	3.5
Read service manual	2.5
Listen to customer's description of problems	2.5
Write phone message	1.7
Write accident report	0.5

Phase 3 importance data on secondary school teachers were obtained using a 4 point scale based on the following question (Willett and Hermann, 1989):

How important is each of the competencies (skills) in your job:

1 - not at all important
2 - moderately important
3 - very important
4 - extremely important

Averages of the results of practising secondary school teache.s include:

Give clear instructions	3.95
Mark student work	3.68
Elicit discussion and participation	3.42
Provide range of instructional methods	3.29
Talk to students outside class	3.17
Liaise with ancillary staff	3.06
Record lesson plans, fill in register	2.68
Prepare and supervise sport	2.42

As part of the same study, Phase 3 data were also obtained for relative time spent, using the following question:

How much time did you spend on each of the competencies?

1 - no time spent on this task/competency
2 - very little time
3 - some time
4 - a great deal of time

Averages of the results of the same secondary school teachers include:

Mark student work	3.55
Give clear instructions	3.25
Provide range of instructional methods	3.17
Elicit discussion and participation	3.15
Talk to students outside class	2.87
Liaise with ancillary staff	2.70
Prepare and supervise sport	2.57
Record lesson plans, fill in register	2.51

A total program can be divided into three segments: college segment, in-plant off-the-job segment, and in-plant on-the-job segment. As indicated on Diagram 2, data on the 'Level of Importance' and 'Frequency of Performance' of a specified competency can assist in determining in which of the three segments it should be presented.

Such curriculum questions as: In which segment(s) should the competency be taught? Should the course have a core plus electives? When in the course should the material be taught? can be assisted by relevant competency data. Step 3.1 addresses the question: Which categories of data will be of most use for the development of the course?

An inventory method (such as CODAP) of job incumbents is the most comprehensive OA technique for collecting data on competencies; however, it may be feasible, depending on circumstances, to collect data from a group session of representative job incumbents. (It is considered that supervisors of job incumbents should generally only be used if the job incumbents cannot readily provide the data.) However, if CODAP is required for clustering (Step 3.3), then CODAP should be used for Step 3.2 (obtaining data on each competency).

An example of clustering of Phase 3 data. Hayton (1984) collected data on an inventory of competencies from 344 training and development personnel in Australia. Using a CODAP computer program, the following clusters of occupational activities were detected:

Training and development personnel clusters

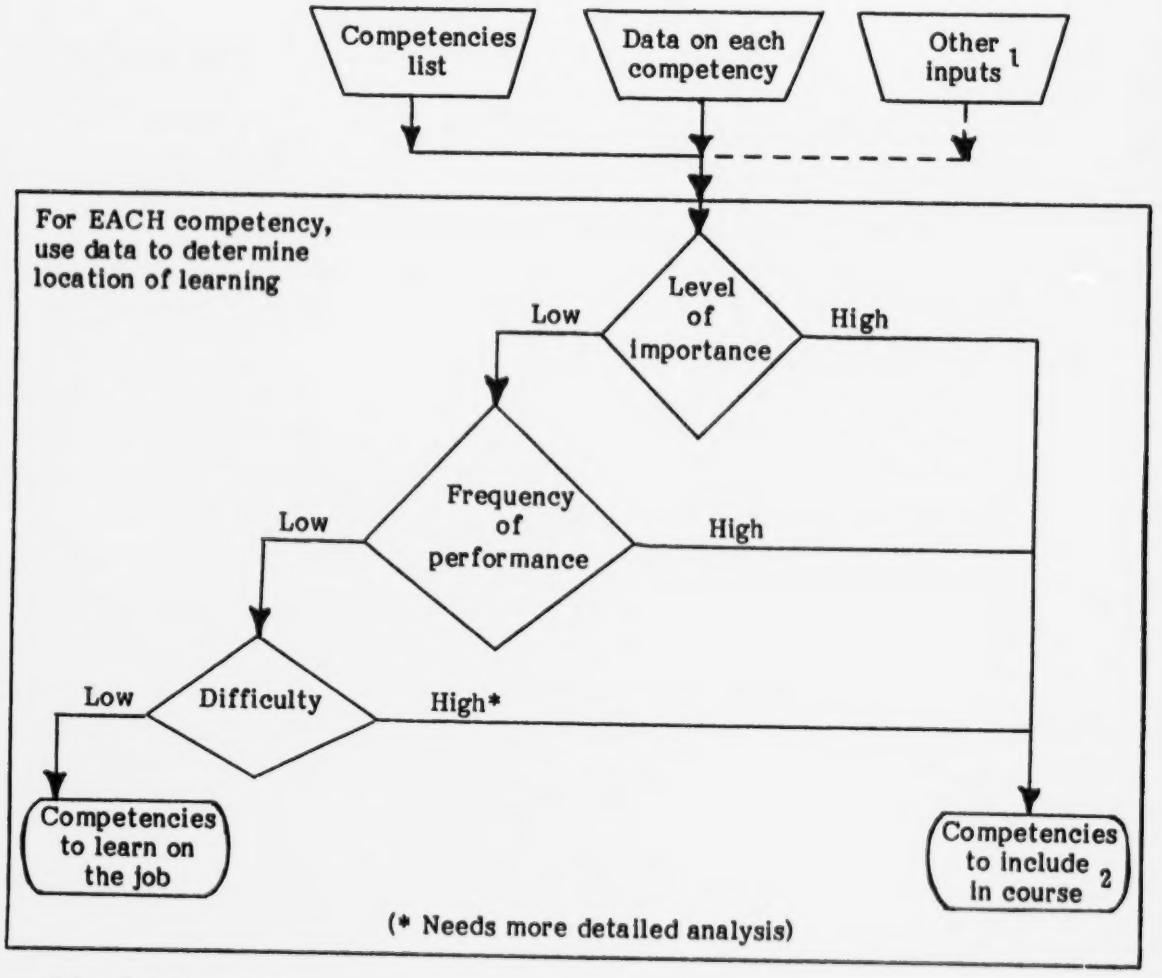
Term assigned to cluster	Primary duties
Instructor	Instruct employees
Officer	Instruct employees; design training programs
Program officer	Design training programs; prepare instructional materials
Program manager	Design training programs; instruct employees; manage training and development
Research manager	Research training and development; manage training and development; analyze training needs
Manager	Manage training and development; supervise external programs; evaluate and train trainers; counsel staff; liaise with managers.

Phase 3 is discussed in more detail in Section B of this Manual.

Diagram 2: USING OA DATA IN COURSE DEVELOPMENT

Guide flowchart (NOT prescriptive)

(a) Short course



(b) Longer course

Could obtain from OA:

- data re clusters (Step 3.3) to assist in determining core/electives alternatives
- data re Immediacy (Step 3.2) to assist in sequencing of topics in the course.

1. E.g. existing competencies of learners; available resources.
2. In-plant off-the-job and/or college segment(s).

SECTION B

THE THREE PHASES OF OCCUPATIONAL ANALYSIS

It is generally inappropriate to select <u>one</u> OA technique for use across all 3 phases:

Phase 1 - Determining the nature and scope (general parameters) of the occupational area
Phase 2 - Developing a competencies list
Phase 3 - Collecting data on each competency

This section provides a set of flowcharts and discussion to assist the selection of appropriate OA technique(s) for each step of each phase.

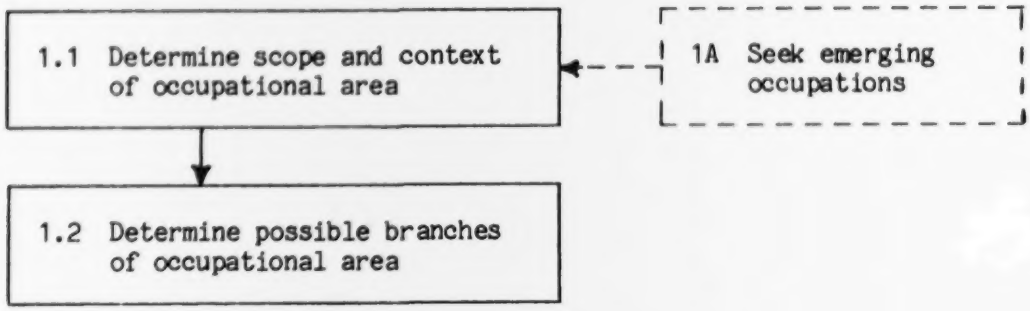
The OA techniques referred to in this Section are discussed in Section C.

NOTE

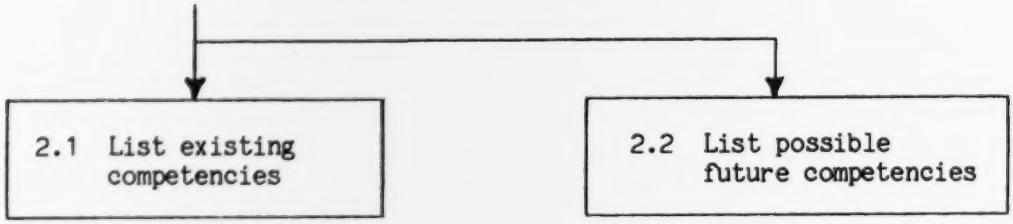
It is vital to have an adequate description of the occupational area from Phase 1 before proceeding to Phase 2.

B. THE THREE PHASES OF OCCUPATIONAL ANALYSIS

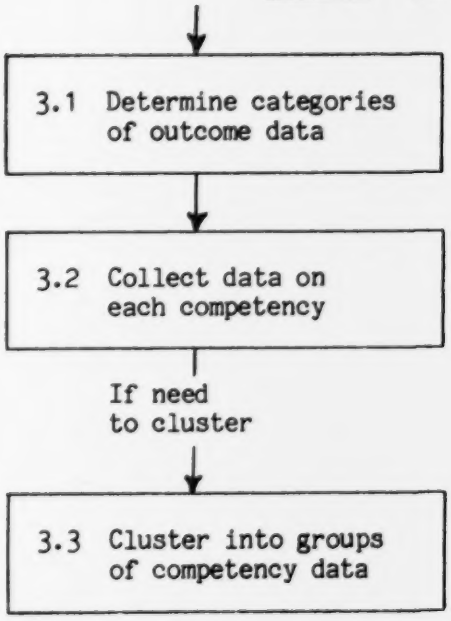
PHASE 1 Nature and scope of occupational area


1.1 Determine scope and context of occupational area
1A Seek emerging occupations
1.2 Determine possible branches of occupational area

PHASE 2 Competencies list



PHASE 3 Data on each competency


3.1 Determine categories of outcome data
3.2 Collect data on each competency
If need to cluster
3.3 Cluster into groups of competency data

PHASE 1. GENERAL PARAMETERS OF OCCUPATIONAL AREA

The primary objective of this phase is to determine the boundaries of the occupation or subset of an occupation for the purpose of the exercise.

One may wish to collect OA data across all the engineering occupations, or across the mechanical engineering professional and paraprofessional occupations, or across the engineering trades occupations, or across those personnel in a variety of occupations who constitute the 'initial customer contact person' in an enterprise. Alternatively, one may wish to collect OA data on a reasonable circumscribed occupation (such as bartender), or on a small part of an occupation (such as the business skills needed by a self-employed plumber).

Although the issues to be analysed tend to be the same no matter how narrow or broad the specification, there tend to be differences in the applicability of specific OA techniques for exercises of different sizes.

Other objectives of this phase: To determine

- Contextual constraints (e.g. legal, financial)
- Context, including key factors acting on and changing the occupational area, such as technological, economic, social (including environmental) and industrial (including work organization)
- Coverage (e.g. National, State, Regional, Enterprise)
- Relevant career paths (both vertical and horizontal)
- Existing education/training
- Data disjunctions (i.e. inconsistent data sets; as discussed by Anderson and Jones, 1986a, p.26).

It is often useful to employ a tabular format (such as Table 1) to collect these data. Table 1 provides for occupational areas covering a number of industries; e.g. electrical workers are found in construction, manufacturing, transport, and other industries.

Major end-products of Phase 1 are:

(i) a written description of the occupational area (ready for use in Phase 2).

(ii) an analysis of recent and possible future changes.

(iii) a list of the dimensions (strata) which may bound subsets of the occupational area.

Step 1A: Seek emerging occupations

Methods used to attempt to detect emerging occupations include:

- relevant OA techniques (e.g. information search; observation; surveys into equipment ordered/changes planned/new technology to be employed; interview of experts such as researchers, consultants, and technical managers; Delphi; Search Conference; Nominal Group Technique; analysis of career paths of ex-students).

- looking for overlapping across existing occupations (such as sought in Table 1).

- monitoring employer/union discussions (e.g. current developments in the Australian metal trades industry).

Step 1.1: Determine general parameters of occupational area

The major end-product of this step is a written description of the occupational area.

The following is an example of the scope (boundaries; description) of an occupational area.

DEBTORS CLERK

The person whose primary function is to perform clerical and monitoring activities to ensure that the money owed to the enterprise is repaid in accordance with the enterprise's trading terms. This includes 'chasing' debtors by phone and letter.

It does not include:

- approaching debtors in person
- setting up the system
- determining policies

Table 1: A guide for collecting data for Step 1.1

Occupational area:

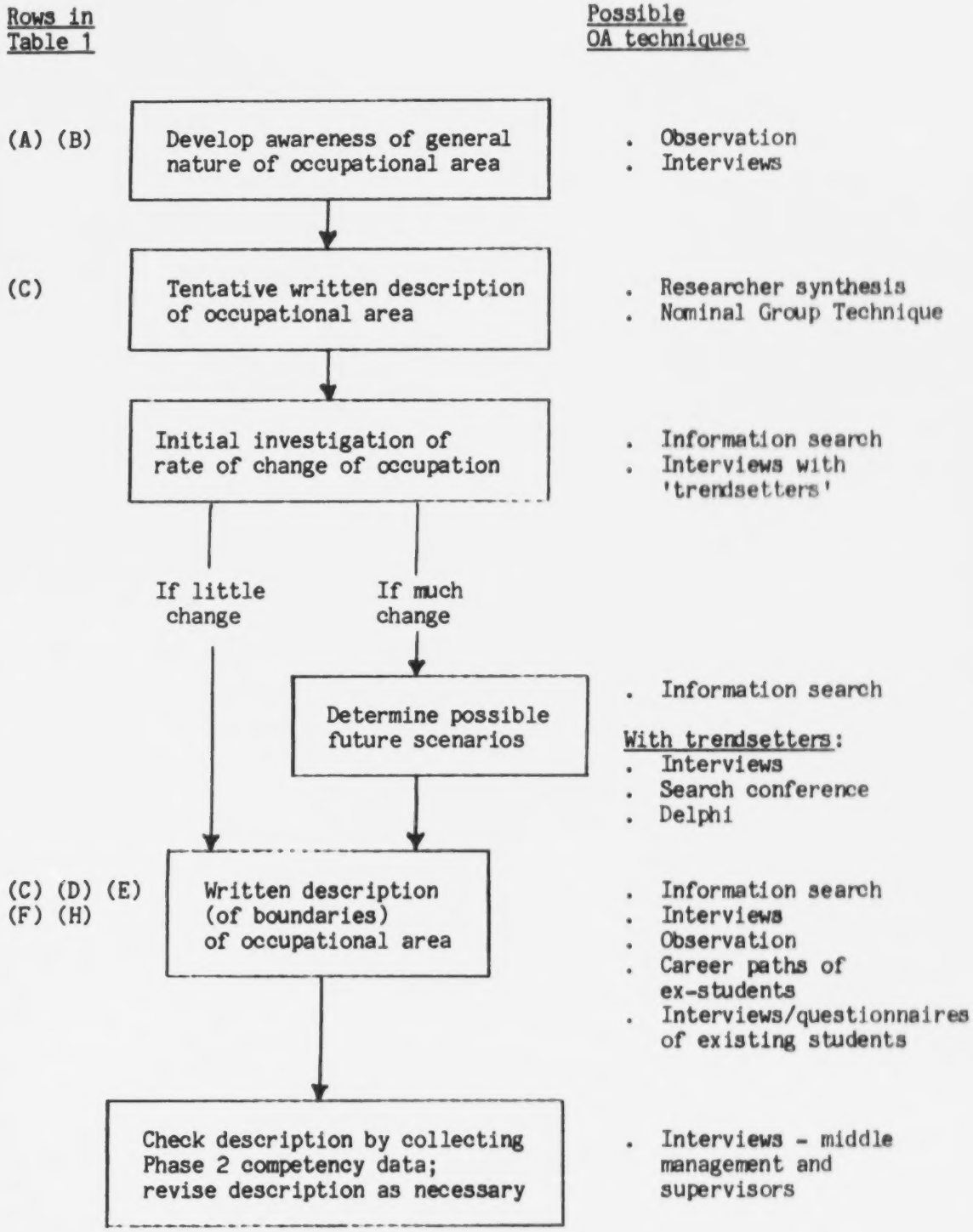
Coverage: National State Region Enterprise

Row	Industry 1	Industry 2	etc.
(A) Name of industry			
(B) Occupation(s)			
(C) Major job functions			
(D) Recently-introduced competencies			
(E) Recently-discarded competencies			
(F) Typical career path(s)			
(G) Number of persons			
(H) Overlap with other occupations (name occupations and competencies)			
(I) Existing education/training*			
(J) Legal constraints			
(K) Comments (including factors changing occupational area)			

* Asterisk if education/training appears inadequate

Step 1.1 Flowchart. (a) Determine boundaries of occupational area

If the boundaries of the occupational area are self-explanatory, this detailed procedure can be omitted. However, a written description still should be produced.


Rows in Table 1
Possible OA techniques
(A) (B)
Develop awareness of general nature of occupational area
. Observation
. Interviews
(C)
Tentative written description of occupational area
. Researcher synthesis
. Nominal Group Technique
Initial investigation of rate of change of occupation
. Information search
. Interviews with 'trendsetters'
If little change
If much change
Determine possible future scenarios
. Information search
With trendsetters:
. Interviews
. Search conference
. Delphi
(C) (D) (E) (F) (H)
Written description (of boundaries) of occupational area
. Information search
. Interviews
. Observation
. Career paths of ex-students
. Interviews/questionnaires of existing students
Check description by collecting Phase 2 competency data; revise description as necessary
. Interviews - middle management and supervisors

Step 1.1 Flowchart. (b) Determine context of occupational area

(i) This procedure is frequently undertaken concurrently with Step 1.1(a).

(ii) The contextual data to be collected will depend on the objectives of the Phase I analysis.

Row in Table 1	Data which can be collected (depending on objectives)	Possible OA techniques
(G)	Labour force data; industry data; economic changes	. Information search
(I)	Existing education/ training	
(J)	Legal data	
(K)	Technological change; social/environmental change; industrial/work organization change	. Information search . Interviews/group discussions with experts
	Perceptions of effectiveness of practitioners in the occupation	. Interviews/group discussions with clients of the occupation

Step 1.2: Determine possible branches of occupational area

The major end-product of this step is a list of the dimensions (strata) which may bound subsets (branches) of the occupational area. Such a list has two major uses:

- as a guide to the homogeneity of the occupational area
- as a basis for seeking reasonable representation across the occupational area (i.e. to ensure that the sampling procedure can be justified).

Boundaries of subsets may be determined with respect to (i) type of competencies and/or (ii) range of competencies and/or (iii) sophistication of competencies.

Possible dimensions include:

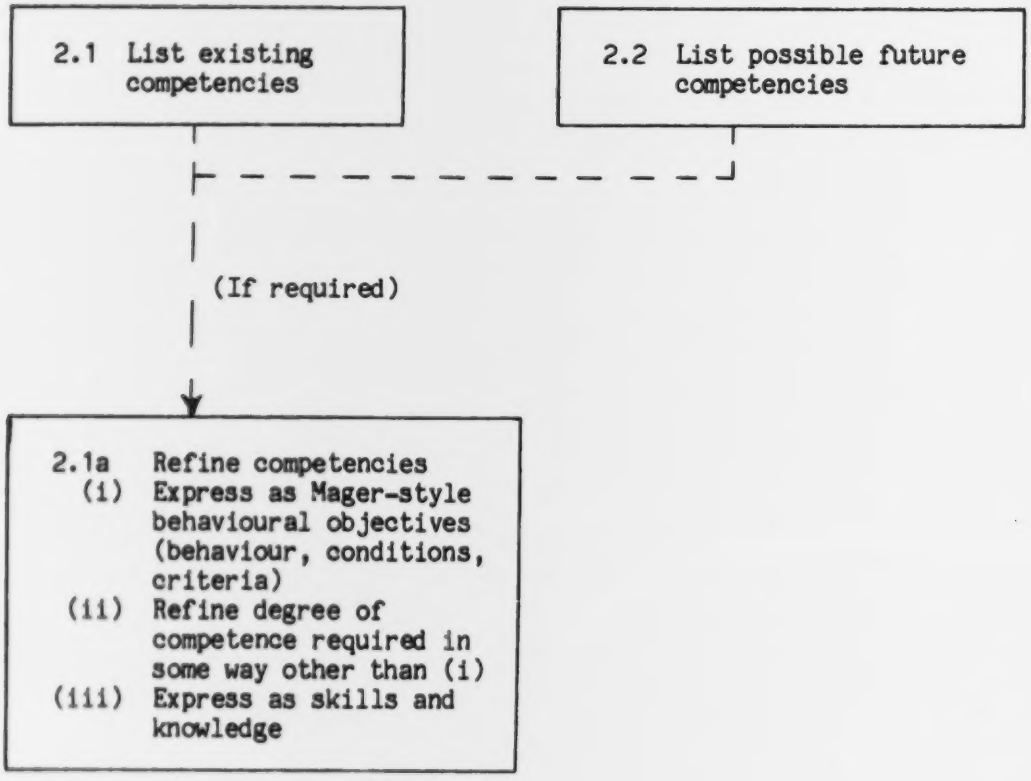
- branch of occupation
  e.g. 1. branches of Chemistry include metals, organic, instrumental, etc.
  2. manufacture vs service vs repair vs sales/distribution.
- size of occupational area in a specific enterprise
- urban vs rural
- government sector vs private sector
- degree of supervision.

Methods used to detect subsets of an occupational area include:

- relevant OA techniques
  - information search
  - interviews
  - group (Delphi or Search or Nominal Group Technique)
  - career paths of ex-students
- charting subsets using a table similar to Table 1.

(Note that the findings from this step can be refined - as discussed in Step 3.3).

PHASE 2. COMPETENCIES LIST


2.1 List existing competencies
2.2 List possible future competencies
(If required)
2.1a Refine competencies
(i) Express as Mager-style behavioural objectives (behaviour, conditions, criteria)
(ii) Refine degree of competence required in some way other than (i)
(iii) Express as skills and knowledge

The objective of this phase is to produce a list of competencies (performances/capabilities) that are presently performed and/or may be performed in the near future. Such a list should probe for cognitive (knowledge and thinking), affective (attitudinal), and psychomotor competencies.

There are many OA techniques, some of which are listed in Section C. The Phase 2 flowcharts are designed to answer the question: Given my conditions (resources, constraints, etc.), for a specified occupational area, **which OA techniques should I use to develop a list of competencies?** Some assumptions built into these flowcharts are:

- If two or more OA techniques would appear to be able to produce comparable data, the techniques chosen should be based on least cost and fastest production of data.
- As a check on the consistency of data, at least two different OA techniques should be used, involving two different sources of data (generally groups of people). At least one data source should be job incumbents and/or their supervisors.

- A preliminary Information Search should always be undertaken.

- Competencies can be classified into two groups: those readily identified (termed 'conventional'), and those which may need much probing to detect (termed 'refractory') - see below.

- If a representative group of workers in an occupational area (and/or their supervisors) can readily meet together, DACUM would appear to be an optimum method (as the structure of DACUM provides inter alia for interaction among participants, which may generate data not always obtained by separate interviews of the same persons).

- If it is difficult for a representative group of job incumbents/supervisors to meet together, a series of a modified DACUM approach (with 1-3 persons from an enterprise) may be used over a set of representative enterprises. Alternatively, or additionally, Competencies Interviews of Job Incumbents (as described in Section C) and/or Observation + Interview of Job Incumbents may be undertaken.

- For refractory competencies, Critical Incident and/or Observation + Interview techniques are needed.

- Step 2.1 should continue until consistent data are obtained.

- For Step 2.2, it is possible to identify trendsetters (enterprises which are early adopters of innovations).

Many of the above assumptions are supported by the results of empirical studies reported in Mottram and Hermann (1989).

Competencies can be classified into two major groups:

A. Conventional competencies - those traditionally found by OA techniques:

   (1) Psychomotor
   (2) Cognitive procedures (e.g. accounting procedures)

B. Refractory competencies - those which tend to need more probing to detect in many occupational areas:

   (3) Communication
   (4) Interpersonal
   (5) Management/supervision
   (6) Planning
   (7) High-level cognitive (problem-solving, analyzing, synthesizing, evaluating)
   (8) Safety
   (9) Attitude-related.

It is vital to have an adequate description of the occupational area from Phase 1 before proceeding to Phase 2.

Step 2.1 Flowchart List existing competencies

If competencies are primarily conventional, use at least two of the following OA techniques :

DACUM
Extended Information Search
Observation plus Interview
Competencies Interview

with job incumbents.

If there are some refractory competencies, use :

Observation plus Interview,

PLUS at least two of the following :

DACUM
Extended Information Search
Competencies Interview
Critical Incident Technique *

with job incumbents.

---

* Useful for Interpersonal competencies; it can be used with the same respondents immediately after the completion of some other techniques (e.g. Competencies Interview; DACUM; Observation plus Interview).

Step 2.2: List possible future competencies

In Step 2.1 which investigated the present performance of competencies, the persons involved are those who know most about current usage: i.e. job incumbents and/or their supervisors. In comparison, for Step 2.2, there is a different group of persons involved - those with an understanding of technological and other changes taking place locally and overseas. Such people include:

- researchers
- consultants
- technical managers*
- technical salespersons.

Some possible OA techniques include:

- Information Search (this is most useful if countries are identified which tend to be slightly ahead of Australia in developments in the occupational area, and which have provided a model for previous Australian developments)
- interviews*
- Search Conference or Delphi
- surveys of equipment ordered*
- seek firms that have adopted equipment, and use Step 2.1 procedure.

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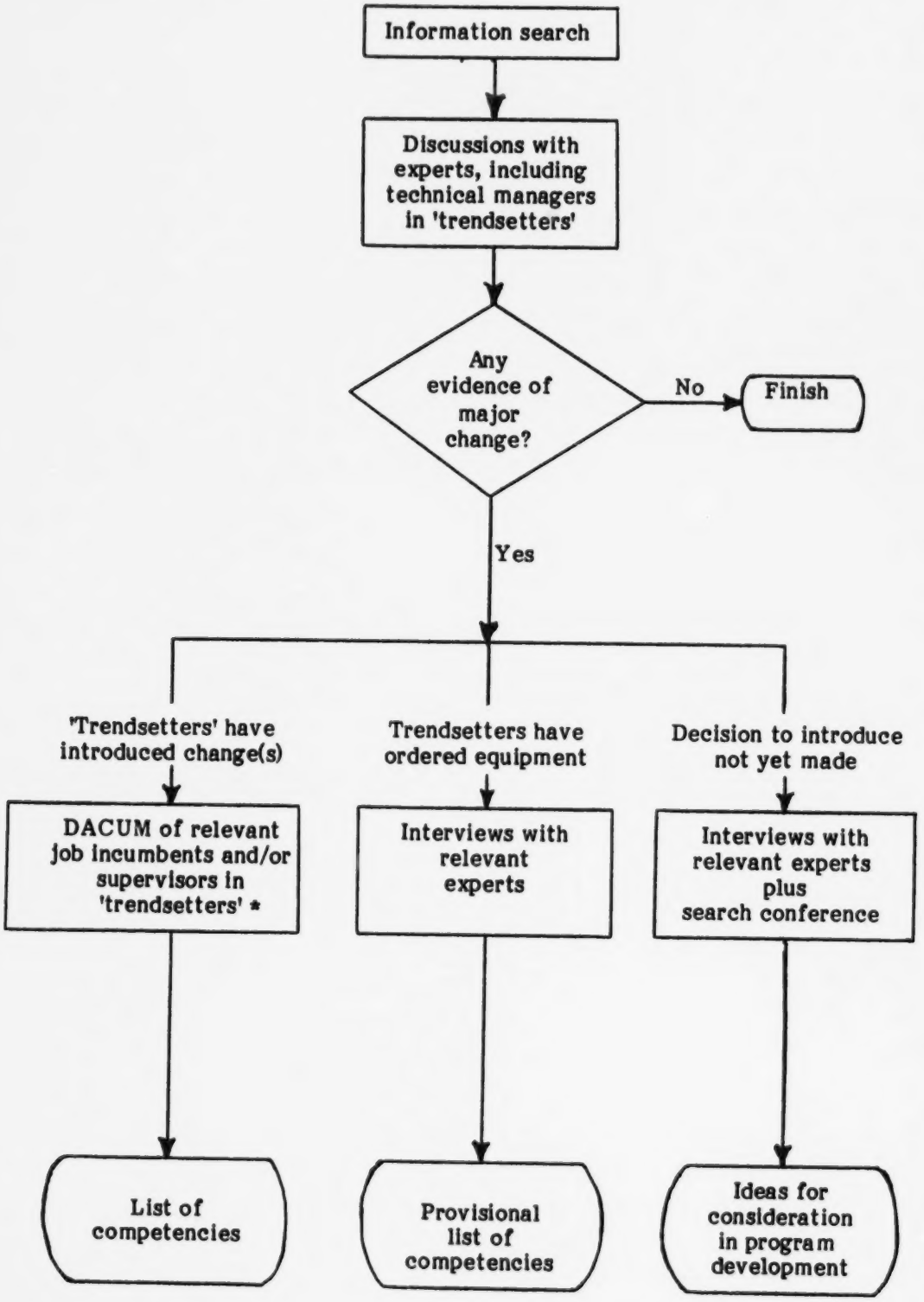
* An emphasis could be given to 'trendsetters' - those enterprises which tend to be early adopters of new technology/materials/etc.

Step 2.2 Flowchart List possible future competencies


Information search
Discussions with experts, including technical managers in 'trendsetters'
Any evidence of major change?
No
Finish
Yes
'Trendsetters' have introduced change(s)
Trendsetters have ordered equipment
Decision to introduce not yet made
DACUM of relevant job incumbents and/or supervisors in 'trendsetters' *
Interviews with relevant experts
Interviews with relevant experts plus search conference
List of competencies
Provisional list of competencies
Ideas for consideration in program development

* or Inteview and/or Observation + Interview

Step 2.1a: Refine competencies

(i) Express as behavioural objectives

In addition to stating the performance (behaviour), one can also state the conditions under which the performance is tested, and the minimum level of competence (criteria; standards), as recommended by Mager (1962).

(ii) Other refinements of degree of competence

Personal responsibility

. **degree of supervision**

e.g. rating scale used in DACUM technique

Can perform this task with more than acceptable speed and quality, with initiative and adaptability and can lead others in performing this task	6
Can perform this task with more than acceptable speed and quality and with initiative and adaptability to special problem situations	5
Can perform this task satisfactorily without supervision or assistance with more than acceptable speed and quality of work	4
Can perform this task satisfactorily without assistance and/or supervision	3
Can perform this task satisfactorily but requires periodic supervision and/or assistance	2
Can perform this task, but not without constant supervision and some assistance	1
Cannot perform this task satisfactorily for participation in a work environment	0

(Note that this scale combines supervision and leadership with speed and accuracy)

- **decision making**
- **personal responsibility**

(iii) Express competencies as skills and knowledge

PHASE 3 DATA ON EACH COMPETENCY

This phase consists of three major steps:

3.1 The determination of the categories of outcome data to be collected

3.2 The determination of the OA techniques to be used to collect data on each competency

3.3 If required, the clustering of the data.

3.1 The determination of the categories of outcome data

The categories of outcome data can be considered within three major groups:

(i) extent of performance of each competency.

(ii) importance of each competency.

(iii) assistance in program development.

(i) Extent of performance of each competency

- **performed/not performed**
- **frequency of performance**

- **relative time spent**

e.g. 1. Time spent

1 = a very little amount of time
9 = a very large amount of time

1 2 3 4 5 6 7 8 9

e.g. 2. Time spent

1 = very much below average
2 = below average
3 = slightly below average
4 = about average
5 = slightly above average
6 = above average
7 = very much above average

(Morsh and Archer, 1967, p.39)

Frequently, one asks the additional questions:

- number of hours per week normally spent on the above tasks,
  and
- number of hours per week normally spent on other tasks (not included in the inventory, together with a brief statement of the nature of the tasks).

Relative time spent is the outcome data variable preferred by CODAP users.

- **actual time spent**

  e.g. hours per week

(ii) Importance of each competency

- **importance**
- **criticality**

- **consequences of inadequate performance**

  e.g. 1 = minimal
  5 = serious
  9 = extremely serious

  1 2 3 4 5 6 7 8 9

(iii) Assistance in program development

- **difficulty in learning competency**

  e.g. 1 = little time to learn
  5 = average time to learn
  9 = very long time to learn

  1 2 3 4 5 6 7 8 9

- **where competency was learned**

  e.g. 1 = all from education institution
  2 = almost all from education institution
  3 = mostly from education institution
  4 = about fifty-fifty education institution and work experience
  5 = mostly from work experience
  6 = almost all from work experience
  7 = all from work experience

  1 2 3 4 5 6 7

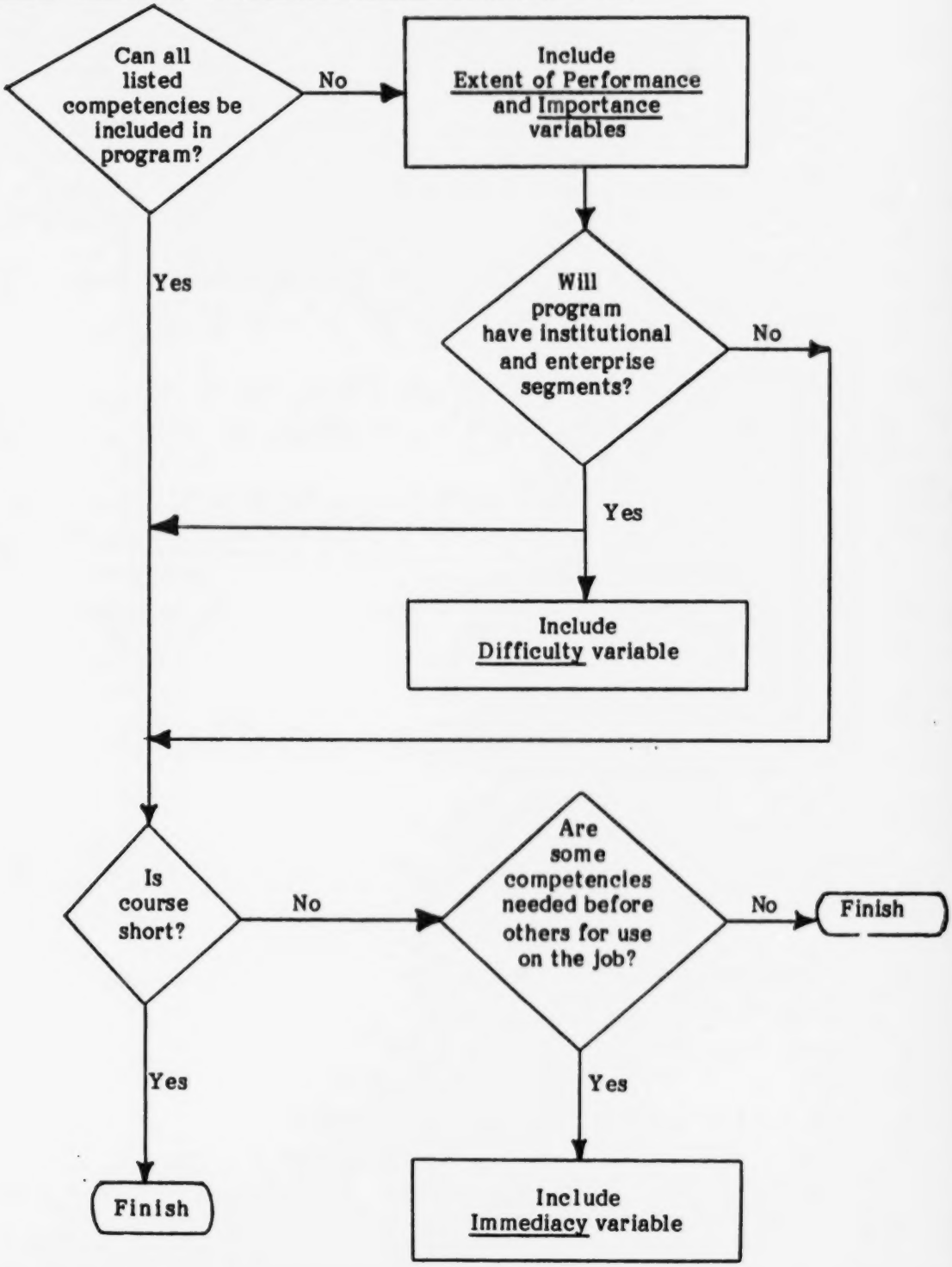
- **immediacy**

  i.e. weeks after the appointment that job incumbent will need competency for use on the job.

- **trend data**

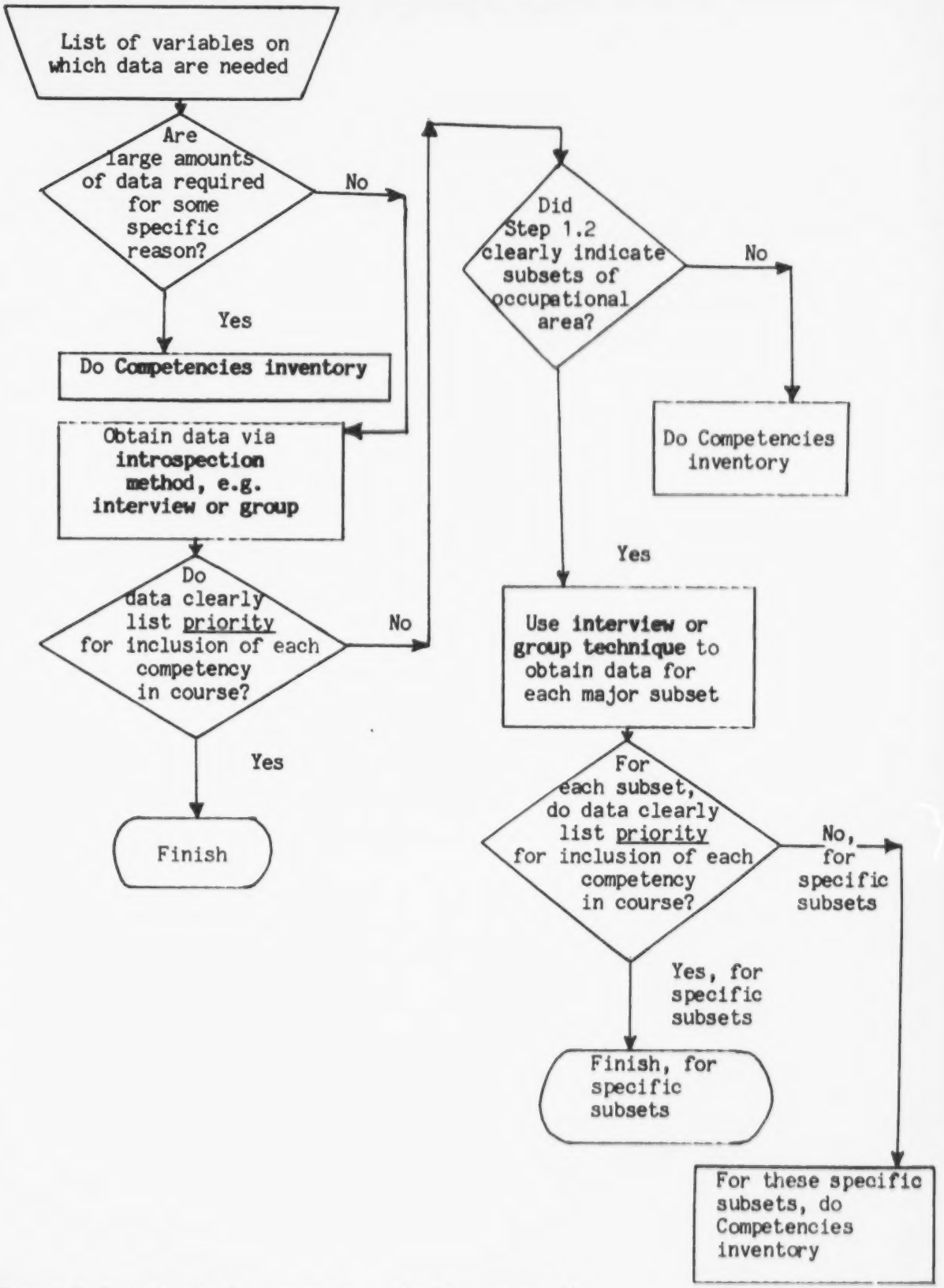
  e.g. year introduced
  year superseded

Step 3.1 Flowchart* Determine categories of outcome data



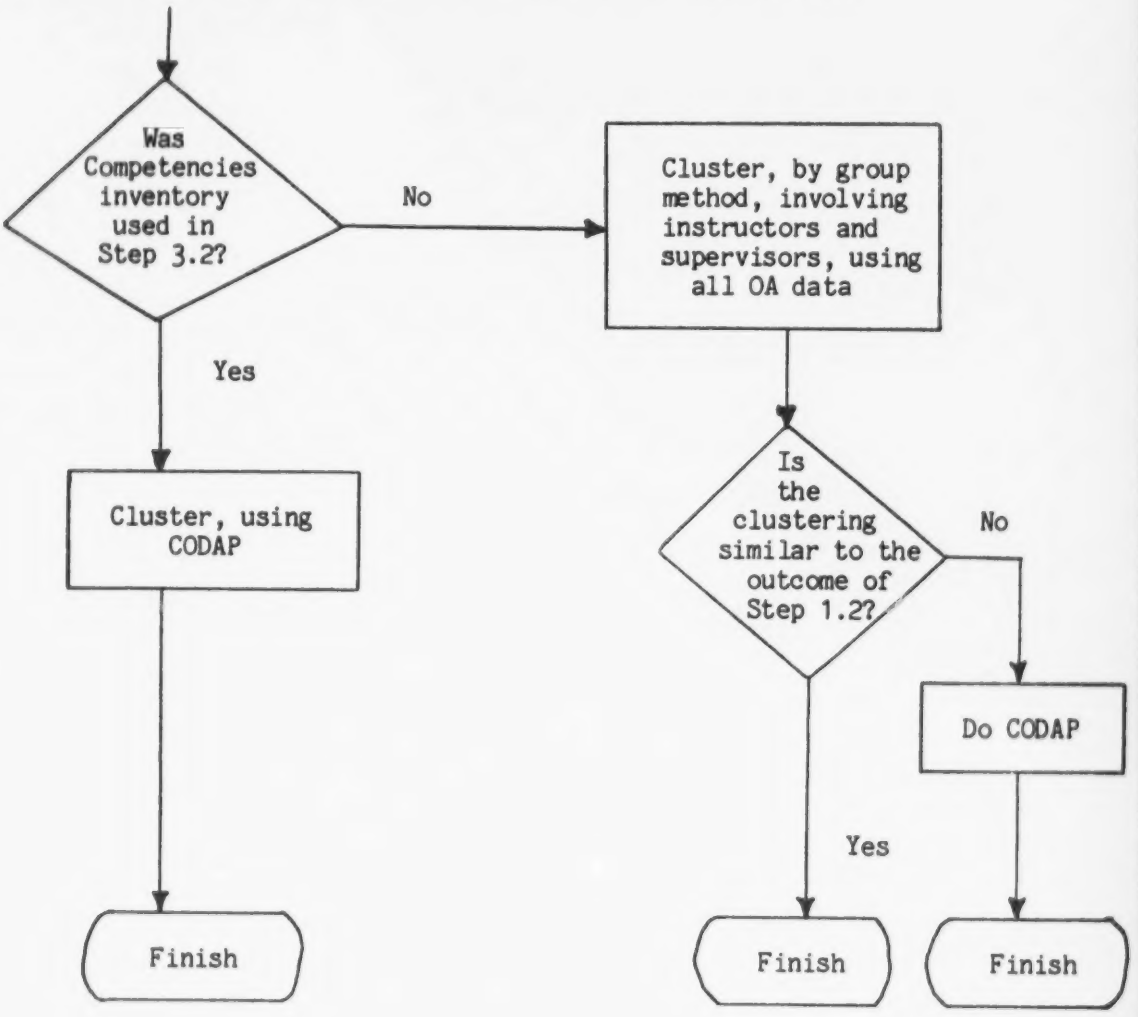
* This flowchart has been developed on the assumption that Phase 3 data need not be obtained if it is readily possible to teach all listed competencies.

Step 3.2 Flowchart Collect data on each competency*


List of variables on which data are needed
Are large amounts of data required for some specific reason?
No
Yes
Do Competencies inventory
Obtain data via introspection method, e.g. interview or group
Do data clearly list priority for inclusion of each competency in course?
No
Yes
Finish
Did Step 1.2 clearly indicate subsets of occupational area?
No
Do Competencies inventory
Yes
Use interview or group technique to obtain data for each major subset
For each subset, do data clearly list priority for inclusion of each competency in course?
No, for specific subsets
Yes, for specific subsets
Finish, for specific subsets
For these specific subsets, do Competencies inventory

* From job incumbents (supervisors only if necessary)

Step 3.3 Flowchart Cluster into groups of competency data



SECTION C

OCCUPATIONAL ANALYSIS TECHNIQUES

This section is in two parts:

I - **A categorization of OA techniques**

II - **Descriptions of selected OA techniques:**

- Information Search
- Extended Information Search
- Observation
- Observation + Interview
- Interviewed Individuals
- Competencies Interview
- DACUM
- Nominal Group Technique
- Critical Incident Technique

C. OCCUPATIONAL ANALYSIS TECHNIQUES

This section is in two parts. A listing of OA techniques is provided in Part I, and descriptions of selected methods are presented in Part II.

Comparisons between some techniques are presented in Rayner and Hermann (1988); Willett and Hermann (1989); and Mottram and Hermann (1989).

Part I

A Categorization of OA Techniques

OA techniques may be discussed as five groups:

A. Desk methods.
B. Field methods.
C. Inventory methods.
D. Introspection.
E. Indirect methods.

A: Desk methods

A.1: Information search*

Also called literature review.

A.1.1: Extended information search* (Information search + introspection).

This combination of OA techniques is especially relevant to Phase 2. An information search is undertaken to obtain a draft list of competencies; this list is revised and augmented based on comments, and suggestions of other competencies, from relevant persons (such as people in industry and teachers).

A.2: Analysis of existing programs

A useful technique for Phase 1, but should never be the only technique employed.

B: Field methods

B.1: Observation*

B.1.1: Observation + Interview*

B.2: Learning to perform a job

An occupational analyst (eg. a curriculum developer) learns how to do a job.

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* This technique is described in Part II.

B.3: Teacher(s) working in industry

This technique involves college teachers/industrial trainers spending a period working in the occupational area in industry, and may include aspects of B.1 and B.2 above.

B.4: Daily work diaries of job incumbents

C: Inventory methods

These are known as systematic survey methods when they aim to obtain large masses of quantifiable 'hard' data from a **representative** sample of respondents, generally job incumbents and/or their immediate supervisors.

Inventories can be filled in by the interviewer during interviews, or by respondents either individually (by mail, or in the presence of the occupational analyst) or in groups.

C.1: Competencies inventory (specifically devised)

This type of competencies inventory is specifically developed for the unique occupational area. It is used to collect Phase 3 data, such as extent of performance of each competency, importance of each competency, and immediacy of each competency. The list of competencies is normally obtained from a combination of OA techniques, such as Information Search, Observation, Interviewed individuals, DACUM, Critical incident technique, and Extended information search (the information search is used to obtain a draft list of competencies, which is complemented by competencies suggested by people in industry, teachers, and other relevant persons).

The competencies inventory technique is often termed Task Analysis, and is widely discussed in the literature (eg. Finch and Crunkilton, 1979).

A competencies inventory often lists both tasks and skills. Inventories may be developed which list only tasks, or only skills, or only cognitive competencies.

A competencies inventory should always leave space for respondents to add specific competencies they perform, but which were not listed in the inventory.

C.1.1: CODAP

CODAP stands for Comprehensive Occupational Data Analysis Programs. These computer programs and the related methodology have been developed by Christal and his colleagues for use by the US Armed Forces (e.g. Christal, 1974; Morsh and Archer, 1967). A CODAP survey typically involves:

- a list of about 500 tasks (for a complete occupation).
- a large number of respondents (500-7,000), who perform the job, answering questions on a relative time spent scale (e.g. 1 means 'extremely small amount of time on a task compared to other tasks', while 7 means 'extremely large amount of time on a task compared to other tasks').

- a smaller number of supervisors, answering questions on consequences of inadequate performance ('minimal' to 'extremely serious'), and task difficulty ('little time to learn' to 'very long time to learn').

- a series of analyses, which may include clustering of tasks.

An example of a CODAP analysis is: Hayton, G. (1984). The job profiles of training and development personnel in Australia. Berger and Hawkins (1979) present a good introduction to CODAP.

In this manual, the CODAP methodology is specifically mentioned in Phase 3 only; the list of competencies can be obtained using a variety of sources, such as DACUM, Observation, Interview, and/or Critical Incident Technique. CODAP computer programs are available in Australia.

C.2: "Off-the-shelf" competencies inventory

These are "permanently" available competencies inventories, devised and evaluated in a systematic way, and able to be bought/obtained from the publisher/designer.

There are a number of categories of such inventories.

C.2.1: Designed for a specific occupation

e.g. Management, retail industry, nursing.

C.2.2: Designed for a variety of occupations

- Position Analysis Questionnaire (PAQ)

The PAQ consists of 194 job elements divided into six divisions titled: (a) Information Input; (b) Mental Processes; (c) Work Output; (d) Relationships with Other Persons; (e) Job Context; and (f) Other Job Characteristics (McCormick, Mecham & Jeanneret, 1977). The analysis is carried out by numerically rating the applicability of each job element to the position in question.

Completion of the questionnaire may be conducted by the incumbent, the supervisor, or an independent occupational analyst.

Burnett and McCracken (1982) found the PAQ useful for identifying the types of activities associated with an occupational area, and for investigating interpersonal relationships. They recommend that it be one of (at least) two OA techniques in developing an inventory of competencies specific to the occupational area.

- Job Components Inventory

This inventory contains six sections: tools and equipment, physical and perceptual skills, mathematical skills, communication skills, decision making and responsibility, and job conditions (Banks et al., 1979).

C.2.3: Designed to indicate "core competencies" for a variety of occupations

. Core skills in YTS

This inventory contains 103 "core" competencies in four major groups: number, communication, problem solving, and practical (MSC, 1984).

C.3: Equipment inventory

C.4: Innovation inventory

These concern equipment ordered, changes planned, and new technology to be introduced. Respondents will normally be 'technical' managers.

D: Introspection

This method is based on one or more individuals, knowledgeable concerning an occupation, expressing opinions concerning that occupation. (Methods D.1 to D.5 are often extremely useful in Phase 1 - determining the parameters of the occupational area).

D.1: Individual

This could involve an individual teacher describing an occupational area in terms of personal experience. See Finch and Crunkilton (1979).

D.1.1: Extended individual introspection (Individual introspection + additional introspection).

This combination of OA techniques is especially relevant to Phase 2. An individual (e.g. teacher, instructor, or person in industry) develops a draft list of competencies. This list is revised and augmented based on comments, and suggestions of other competencies, from relevant persons. (This second step is often termed the validation of the list of competencies).

D.2: Data from 'independent' individuals

D.2.1: Interviewed individuals*

This typically involves an interviewer from the education/training agency gaining opinions from a number of people in industry. Interviews could be conducted with job incumbents, supervisors, experts, trendsetters, managers, clients of the occupation, course graduates, etc.

D.2.1a: Competencies Interview*

D.2.2: Incumbents writing out job statements

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* This technique is described in Part II

D.3: Delphi

Delphi is a group consensus method. It is generally used to forecast future events.

A panel of experts is constituted, and asked about a topic (generally using a mailed questionnaire). This information is collated and analysed, returned to the panel members with further questions, and further information is obtained. This feedback procedure is generally repeated until consensus is obtained (or panel members do not further change their opinions).

See Finch and Crunkilton (1979) and Anderson and Jones (1986a).

D.4: Standing Committee

Course advisory committees frequently are used to provide data concerning an occupational area.

D.5: Ad hoc expert committee

D.5.1: DACUM*

D.5.2: SKA seminar

SKA stands for skills/knowledge/attitudes. It uses a group approach to directly determine what job incumbents do (somewhat similarly to a DACUM technique) plus what they need to know (see Anderson and Jones, 1986a).

D.5.3: Search conference

Participants in a Search Conference analyse the future (future scan, desirable and probably futures, prioritizing), the present, and the past in order to develop action plans concerning a specific topic.

See Anderson and Jones (1986a).

D.5.4: Nominal group technique*

See Anderson and Jones (1986a).

D.5.5: Force field analysis

Force field analysis is sometimes used to examine change situations, by analysing the forces (helping and restraining) which are acting on the situation.

May be useful in obtaining Phase 1 data. See Anderson and Jones (1986a).

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* This technique is described in Part II

E: Indirect methods

These may provide elements of data which suggest specific competencies which should/should not be included in an education/training program.

E.1: Function approach

This approach commences at the industry level. The purposes of the industry are determined, and essential functions (e.g. manufacturing, sales, public relations, etc.) are listed. A list of activities is then drawn up for each function, followed by a list of competencies for each activity.

See Finch and Crunkilton (1979).

E.2: Critical incident technique*

E.3: Evaluating existing courses

Respondents could include present and past students, employers, teachers, unions, and the public (especially clients of the occupational area.) Client respondents are especially important if the occupational area deals directly with the public: e.g. tourism, retailing, auto mechanics.

E.4: Cafeteria approach

If students are able to select subjects/modules from a range of offerings, their selection patterns may indicate the utility or otherwise of specific topics.

E.5: Analyzing career paths of ex-students

An example of career path data providing important curriculum information is the movement of many tradespersons, especially in the building trades, into self-employment. The skills needed to run a successful business are typically not taught in a trade course; such occupational data if confirmed suggest that relevant curricula need reconsideration.

E.6: Attrition data

Students may leave a course when they have learnt the topics they feel are relevant. (For example, it may be that many students undertaking para-professional courses are able to perform their job effectively with only a sub-set of the course; see Macdonald, C. Student Attrition in TAFE Certificate Courses. (1984).

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* This technique is described in Part II

E.7: Pilot course

A course is offered on a trial basis, comprehensive feedback is gathered, and the feedback is used to develop a more effective course.

E.8: Inviting public submissions

E.9: Repertory grid

See Anderson and Jones (1986b).

Part II

Descriptions of Selected OA Techniques

The techniques are listed in alphabetic/numeric order, similar to the Part I listing.

A.1: INFORMATION SEARCH

This constitutes a search of information sources, both published and unpublished, and both paper and electronic documents.

The basic rationale is to save time. If previous analyses of the occupational area have been undertaken, these can be the starting point for your analysis. If a previous analysis has been comprehensive, this can greatly reduce your time commitments; all that may need to be done is to ensure that the previous results are applicable to your situation. If someone has already commenced an analysis of the occupational area, your analysis could possibly 'piggy-back' on the analysis already underway.

A search can be considered as an exercise to determine gaps in existing knowledge.

The information search should be imaginative, covering traditional sources (such as ERIC), but also directly seeking information from bodies likely to have investigated the area (e.g. the British EITB for the engineering area, providers of a program for the same or similar occupational area, relevant professional bodies).

The information search should cover both local and overseas materials. For overseas materials, especial attention should be given to countries which are slightly 'ahead' of your region in the occupational area being studied. The search may also be able to provide information on the applicability of someone else's OA to your situation.

Librarians can generally assist in information searching (e.g. with ERIC). Generally, data concerning all three phases are collected concurrently.

Phase 1: Nature and Scope of Occupational Area

Boundaries of occupational area

Materials to be searched could include:

(i) general education/training literature
- Dictionaries of occupational titles (e.g. ASCO)
- ERIC (USA) (especially on CD-ROM)
- National TAFE Clearinghouse (Australia)
- TAFE Projects in Progress (Australia)
- Technical Educational Abstracts (from British sources)

(ii) industry and occupation specific literature;

(iii) documents from equipment suppliers.

Groups who could be approached include:

- Industry Training Committees
- Employer organizations
- Professional/union/employee organizations
- Relevant teachers/lecturers in post-school institutions
- Central TAFE Curriculum Division in each TAFE Authority
- State Training Authorities
- Training divisions of large employers.

Context data

Relevant materials from sources such as the following could be searched:

- Labour force data from a government statistics agency (e.g. Australian Bureau of Statistics)
- Employment authorities (e.g. Australian Department of Employment, Education and Training)
- Government Training Authorities (e.g. Australian State Training Authorities; Training Agency, previously British Manpower Services Commission; British EITB).
- Other groups listed above.

Phase 2: Competencies List

Sources to be searched could include those listed above under Boundaries of occupational area.

The search could discover a competencies list from an OA already undertaken in the occupational area. In this case, the appropriateness of the list for your circumstances should be investigated. It may be that this list has high utility and that relatively little further analysis is necessary.

The search could discover results from studies into career paths of graduates and/or into the 'relevance' of existing programs. Such data can greatly assist in determining the existing competencies of the occupational area.

There are organizations who sell competencies lists:

. DACUM Exchange, ($Can. 2.50 per profile)
Humber College of Applied Arts and Technology,
205 Humber College Boulevarde,
Etobicoke, ONTARIO, M9W-5L7,
CANADA.

. V-TECS Catalogues,
Curriculum Publications Clearinghouse,
Western Illinois University,
Horrabin Hall 46,
Macomb, Illinois, 61455,
U.S.A.

Phase 3: Data on Each Competency

Occasionally, relevant data have been collected for each competency. As for Phase 2, the appropriateness of such data to the local occupational area needs to be determined.

A.1.1. EXTENDED INFORMATION SEARCH

Phase 2: Competencies List

1. Draft list of competencies.

Undertake **Information Search** as described in the previous section. Develop the draft list of competencies.

2. Augmentation of competencies list.

Show draft list of competencies to relevant persons; e.g. supervisors of job incumbents; trainers/teachers of job incumbents.

Show these persons the Phase 1 description of the occupational area. Then ask them to add to the draft list relevant competencies not found in the Information Search. This procedure continues till the flow of additional competencies dries up.

As always, there is a need to ensure that there is representation across the branches of the occupational area.

3. Revision of list by job incumbents.

Select job incumbents who are representative of the branches of the occupational area.

Using the augmented list of competencies from Step 2 above, ask these job incumbents to:

(i) Add competencies that are not on the list that are performed by them and their colleagues in the occupational area.

(ii) Indicate competencies on the list that are not performed by themselves or their colleagues in the specified occupational area.

N.B. Step 3(ii) is **NOT** necessary if Phase 3 data on extent of performance (e.g. frequency, relative time spent) are being obtained from many job incumbents.

At least 20 job incumbents representative of the occupational area are needed for Step 3(ii), to seek to ensure that competencies which are performed are not removed from the list of competencies. In general, some thoughtful analysis is required before a listed competency is removed.

B.1: OBSERVATION

(If an interview procedure is integrated into the observation method (as discussed in Phase 2, 1 (d) below) this combined technique is known as **OBSERVATION PLUS INTERVIEW).**

Persons in the specified occupational area are observed as they perform their occupational functions. Data can be collected on the following:

- tasks performed
- skills used (including 'refractory' competencies as discussed in Phase 2, Section B)
- knowledge needed
- equipment used
- materials used
- responsibility displayed.

It is generally necessary to ensure the co-operation of the persons being observed.

The observations should be conducted in such a way that the job incumbents perform their functions in the normal way. This may mean that the first set(s) of observations in a particular location have to be discarded if it is suspected that the job incumbents are trying to impress the observer. (The presence of an observer generally worries the job incumbent initially, but generally not for long).

It is advantageous if the observer can hear what the job incumbents say to each other and to their clients.

In planning the observation, a decision needs to be made : whether to observe experts, non-experts, or both.

The times of observation need to be varied to include starting-up operations, normal running, finishing a job or shutting down, and any special operations.

As for other techniques, there is a need to identify and to observe across different 'specialisms' within the occupational area (see Step 1.2, Section B).

Phase 1: Nature and Scope of Occupational Area

This will generally be a descriptive exercise, aimed to gain 'insight' into the activities performed in the occupational area.

Phase 2: Competencies List

The generalized procedure is to make observations, to analyze the data if necessary, and to derive competency statements.

1. Devise format of observation instrument.

   The instrument could have a number of columns :

   (a) Actual observation

   What is observed is written down - as points, or in a narrative fashion, as appropriate.

   Categories of persons spoken to, etc. (such as colleagues, clients, persons being supervised) should be noted.

   (b) Context

   Where relevant, the context of the event being observed can be listed (e.g. accident, emergency).

   (c) Inferences of Observer

   In trying to understand why the person being observed does something, the observer can subjectively infer that knowledge is required, or planning is required, or that a specific step was done for safety reasons.

   (d) Comments from job incumbent.

   Where appropriate, the observer can ask the job incumbent why certain operation was done in a certain way.

   If these comments are comprehensively sought, and if the incumbent is asked to specify and discuss other activities performed (but not performed while being observed), the OA technique is termed the **OBSERVATION PLUS INTERVIEW** technique.

   (e) Checklists of categories of data.

   Checklists can be used to seek to ensure that comprehensive data are obtained. For example:

   (i) The list at the start of the section on Observation (including equipment used, materials used, responsibility displayed).

   (ii) The list given in Phase 2 of Section B, and reproduced below:

   A. Conventional competencies - those traditionally found by OA techniques:

   (1) Psychomotor
   (2) Cognitive procedures (e.g. accounting procedures)

B. Refractory competencies - those which tend to need more probing to detect in many occupational areas:

(3) Communication
(4) Interpersonal
(5) Management/supervision
(6) Planning
(7) High-level cognitive (problem-solving, analyzing, synthesizing, evaluating)
(8) Safety
(9) Attitude-related.

(iii) A functions versus topics list. Eg.

Functions	Topics
Give information	Equipment
Give orders	Grievances
Resolve differences	Material
Train staff	Methods
Inspect production	Personnel
Planning	Quality
Etc.	Etc.

(See e.g. O'Neil, H.E. & Kubany, A.J. Observation methodology and supervisory behavior. Personnel Psychology, 1959, 12, 85-95).

(iv) Activities frequently undertaken while reading and writing

Eg. Competencies needed to answer mail.

2. Undertake observations.

As indicated above, care needs to be taken to ensure that refractory competencies are listed. This listing continues until very few additional competencies are being identified.

3. Analyze data.

Some data are straightforward, and require virtually no analyses (e.g. operate cash register; gift wrap a parcel).

Some data require thoughtful analysis. For example, suppose a doctor is observed examining a baby very soon after its birth. Various analyses may lead to the conclusion that the doctor must be able to:

- perform checks of heart rate, respiration, muscle tone, reflexes, and skin colour on baby sixty seconds after birth
- diagnose illness (or wellness)
- initiate treatment (if required)

etc.

Less inference is required if an **OBSERVATION PLUS INTERVIEW** method is used. (The less inference required of an occupational analyst, the better).

4. List competencies.

This is based on the raw data and any analyses.

5. Identify the General Areas of Competence.

The listed competencies are grouped into some 8 to 12 General Areas of Competence. Each group should be reasonably homogeneous, and is given an appropriate name.

6. Assign all competencies to a relevant General Area of Competence.

7. Undertake further observations.

Use the structured listing of competencies (from observations and/or from other sources) to seek to identify any additional competencies.

Phase 3: Data on Each Competency

Data concerning the extent of performance on each competency can be collected by observation.

There are 3 major types of recording:-

(a) Event sampling

This measures the frequency of events. Tally marks are recorded alongside each listed category.

(b) Duration of event

(c) Time sampling

Behaviour is recorded in sequence every x seconds (e.g. every 5 seconds).

For example, the Flanders Interaction Analysis consists of 10 categories:

Teacher talk categories 1 to 7	1	-	Accepts feelings
	2	-	Praises or encourages
	3	-	Accepts or uses ideas of pupils
	4	-	Asks questions
	5	-	Lecturing
	6	-	Giving directions
	7	-	Criticizing or justifying authority
Pupil talk categories 8 to 9	8	-	Pupil response
	9	-	Pupil initiation
	10	-	Silence or confusion

These 10 categories can be used by the observer in a time sampling approach (sampling every 3 seconds), as shown in the following hypothetical data:

5	5	5	5	5	4	4	4	4	8
8	8	8	2	2	5	5	5	5	5
5	6	6	6	10	9	9	7	7	5

(i.e. <u>lecturing</u> followed by <u>asking question</u> followed by <u>pupil response</u> etc.).

B.1.1. OBSERVATION PLUS INTERVIEW

Compared to the **Observation** technique, Observation plus Interview is especially useful if:

- some aspects of the job can't be directly observed
- there is difficulty in comprehending what a person is doing (e.g. when sitting at a desk; when using a computer)
- problem solving, diagnosis, planning, and other cognitive activities are performed.

Phase 2: Competencies List

Procedure

1. Devise format of 'observation plus interview' instrument.

This step is almost the same as for the Observation technique discussed previously, and that discussion is not repeated here.

There would normally be at least 3 columns for an 'observation plus interview' instrument:

- actual observations
- points (questions, etc.) to discuss with the person being observed
- comments by person being observed concerning these points.

2. Undertake observations.

See discussion for Observation technique.

3. Interview with observed person.

In this interview step, the observer seeks two types of data from the person being observed:

(i) Comments (answers) on the points (questions, etc.) raised by the observer

(ii) A list of competencies performed, **but not observed by the observer** (e.g. starting up activities; activities performed on a weekly, monthly, or yearly basis such as stocktaking).

This step may be undertaken concurrently with Step 2. For example; an observer observing a salesperson could 'interview' the salesperson inbetween the salesperson serving customers. Certainly, the interview should take place within the same session (of ca 1-3 hours) that the observations are made.

Steps 4 to 8.

These are the same as Steps 3 to 7 of the Observation technique.

D.2.1: INTERVIEWED INDIVIDUALS

In an OA, an interview may be used for a variety of purposes, and involve different categories of persons, such as trendsetters, managers, job incumbents and/or their supervisors, students, and course graduates.

Phase 1: Nature and scope of the occupational area

This is discussed by Anderson and Jones (1986a) under the heading Exploratory (qualitative) methods.

In general, it is considered that the interview should be primarily structured, but flexible enough to take into account additional major points made by interviewees.

Phase 2: Competencies list

Because of its utility as an OA technique, and because the term 'interview' is used so widely, a unique term has been coined to describe the highly structured form of interview discussed below - the:

COMPETENCIES INTERVIEW

The Competencies Interview is limited to interviewing job incumbents/supervisors to develop a list of competencies (i.e. Phase 2 analysis). As for all Phase 2 analyses, there is a need for representativeness across relevant dimensions such as those listed in Step 1.2, Section B.

Virtually the same interview schedule can be used across all occupational areas. (There are, of course, minor differences between schedules for job incumbents and schedules for immediate supervisors). For each step, the interview should flow freely without interruptions by the interviewer.

Procedure

1. Job outline

An interviewee (job incumbent) outlines his/her job to the interviewer, without interruption from the interviewer.

The precise interview schedule recommended for job incumbents is presented below, in an underlined format. Minor changes need to be made when interviewing supervisors. All responses are, of course, recorded.

"Thank you very much for agreeing to participate in this interview. The aim is to collect information which ... (state reason; e.g. will be used to develop a good training program for ... your occupation ...). Would you please describe what you DO in your job".

When the job incumbent comes to a halt : "Are there any other major activities that you perform in your job?" ... "Could you please describe them".

2. Subdivision of job

The interviewee is asked to subdivide his/her job outline into a small number (about 4 to 6) of separate job duties.

"In most jobs, there are about 4 to 6 major job duties. For example : A pharmacist in charge of a Chemist shop : - dispenses medications, serves customers, manages stock, performs clerical procedures, manages staff, undertakes care of the shop.

"Would you please tell me your major job duties".

When the job incumbent comes to a halt : "Are there any other major job duties?"

3. Listing of competencies

For each of the job duties listed in (2) above, the job incumbent is asked to list the competencies performed (i.e. what he/she actually does). The interviewer encourages the interviewee to freely list competencies, and does not interrupt the interviewee.

"I would now like to find out exactly what you **DO** for each major job duty. Exactly what do you **DO** in ... (state name given by job incumbent to Job Duty 1)?"

When the job incumbent comes to a halt : "What else do you DO in ... (name for Job Duty 1)".

The above procedure is repeated for Job Duty 2, Job Duty 3, etc.

When completed, the interviewer asks : "What else do you DO in your job that you have not already mentioned?"

4. Additional methods used to encourage the interviewee to provide a full list of competencies

(a) The interviewer next asks the interviewee to differentiate between what he/she does in Job Duty 1 from what he/she does in Job Duty 2, in Job Duty 3, etc. This is to encourage the further statement of competencies. This procedure continues for all pairs of job duties, encouraging the interviewee to translate differences into competencies.

"How is ... (name for Job Duty 1) ... different to ... (name for Job Duty 2)?"

If the job incumbent states activities which seem to be additional to those given in (3) above, the interviewer asks : "Exactly what do you DO in ... (name each activity)?"

This procedure is repeated for each pair of Job Duties.

(b) The interviewer next encourages the interviewee to think of any more competencies by handing him/her a card, and reading the contents of the card to the job incumbent.

The card says : "Some occupational areas involve procedures, communications, interacting with others, management/supervision, planning,

thinking and problem solving, and safety. Are any of these performed by you in ... (name for Job Duty 1)?" (Obtain response as competencies).

"Are any of these performed by you in ... (name for Job Duty 2)?"

Continue procedure for each Job Duty.

(c) The interviewer then reviews the description of the job (from Step 1) to determine whether there would appear to be any areas of the description apparently not covered by the interviewee in listing competencies. As necessary, the interviewer encourages the interviewee to provide competencies for these areas.

"In your job description, you mentioned that you do ... (name activity mentioned by job incumbent). Could you please tell me exactly what you DO in this activity?"

This procedure is repeated for each activity apparently not already covered.

5. Clarification of competencies

Should the interviewer have any questions relating to the information obtained in Steps 1 to 4 above (especially concerning the wording/meaning of competencies), these questions are now asked. As appropriate, amendments to competencies are made, any duplication is removed, and any additional competencies are listed.

(THE INTERVIEW IS THEN CONCLUDED).

6. Identify the General Areas of Competence

When all the Competencies Interviews have been completed, the competencies listed by all the interviewed individuals are grouped by the occupational analyst(s) into some 8 to 12 General Areas of Competence. Each group should be reasonably homogeneous, and is given an appropriate name.

All competency statements are assigned to a relevant General Area of Competence.

7. Refinement of the competency statements

Duplications of competency statements are eliminated. A statement is accepted when it is felt that most persons with an adequate background in the occupational area would understand what is meant by the statement.

Findings

The Competencies Interview has been found to be an effective technique by Youngman, Oxtoby, Monk and Heywood (1978), and Mottram and Hermann (1989).

D.5.1: DACUM

Phase 2: Competencies List

Brief Description

DACUM is shortened from 'Developing A CurriculUM', and may be considered as a single-sheet profile of the competencies needed in a specific occupational area.

The procedure involves the identification of about 12 job incumbents and/or supervisors expert in the occupational area being considered. These persons act as an ad hoc committee, following a structured procedure in obtaining grouped lists of competencies. An example of part of a competency profile is given in Diagram 3.

Preparation before the collection of data

The first step is to identify some 6 to 15 persons who are working in the occupational area and/or supervisors of such persons. These persons are termed "experts". As discussed above, it is vital to ensure that these persons are representative of the occupational area being studied (see Step 1.2, Section B).

There are three groups of people invited to the DACUM workshop:

- the experts (in the occupational area), to provide the detailed competencies
- one or two co-ordinators, to facilitate the operation of the workshop; a co-ordinator needs to have some 'introductory knowledge of the occupational area, generally gained by preparing the Phase 1 description of the occupational area
- as **observers**, some 2-4 teachers/trainers, who will subsequently be involved in translating the occupational data into programs, to facilitate the effective use of the competency data.

Depending on the breadth of the occupational area, the DACUM workshop could last for a few hours or a few days; one day is adequate for most occupational areas.

Before the commencement of the workshop, it is necessary to prepare:

- example(s) of DACUM profiles
- a written description of the occupational area to be studied.

The facilities for the DACUM workshop should include:

- a large wall/board for fixing the cards on which the competencies will be written
- cards
- a large sign on the wall/board stating: 'The person must be able to ...'
- the observers being seated behind the participants.

Diagram 3. Part of a competency profile of Pharmacy Assistant

GENERAL AREAS OF COMPETENCE	Competencies					
SERVE CUSTOMERS	Locate product	Operate cash register	Operate credit card machine	Charge item to an account	Advise on use of camera	etc
DEMONSTRATE PRODUCT KNOWLEDGE	Inform customers of similar products	Identify product sizes and strengths	Warn of possible medication side effects	Discuss storage and care of medications	Demonstrate correct use (e.g. make up)	etc
COMMUNICATE EFFECTIVELY; MAINTAIN GOOD CUSTOMER RELATIONS	Display a friendly attitude	Communicate effectively with customers with little English	Clarify and interpret the needs of the customer	Maintain calmness under pressure	Communicate effectively on the phone	etc
APPLY HEALTH AND FIRST AID KNOWLEDGE AND SKILLS	Advise on feeding babies	Advise on skin care	Measure people for crutches and other aids	Weigh babies	Clean and dress minor cuts	etc
MANAGE STOCK	Monitor stock on shelves	Order new stock	Accept deliveries	Organize goods to be returned for credit	Determine price of retail items	etc
ETC						

Procedure

The DACUM Committee is led by a co-ordinator (facilitator), who is typically an expert in course development, and who has had much experience with the DACUM method and with group processes. **The co-ordinator does not suggest specific competencies.**

It is suggested that the precise DACUM terminology be used.

The steps involved in developing a DACUM profile are discussed below.

1. Orientation to DACUM procedure

The co-ordinator will usually:

- Thank the participants for their attendance, and emphasize the importance of their contributions.
- Emphasize that the objective of DACUM is to determine competencies - what the person is to be able to effectively perform on the job. (Each competency commences: The person must be able to ...).
- Discuss the features of DACUM profiles developed by other occupational groups (to help the committee members to visualise the end-product required); emphasizing the distinction between General Areas of Competence, and Competencies.
- Describe the steps to be followed in developing the profile.
- Briefly outline how the education/training program is developed from the profile.

2. Review of the occupational area

The description of the occupational area will have been derived from Phase 1 of the OA.

The co-ordinator will usually:

- Emphasize the key points of a written description of the occupational area (which will generally have been sent to the participants prior to the meeting).
- Encourage analysis of the boundaries of the occupational area, by leading discussion on work performed by persons representative of the area, on job titles of such persons, and so on.

3. Identification of the General Areas of Competence

General Areas of Competence are often called "duties" or "functions" and represent a group of competencies. For an automotive mechanic, such General Areas could include: test and repair brakes; test and repair engine; and test and repair electrical equipment. Alternatively, groups could be developed which cut across these traditional groupings; e.g. use tools and equipment, repair tools and equipment.

For an electronics technician, they could include: select and apply tools and testing equipment; analyze electronic circuits and systems; test, maintain and calibrate electronic equipment; trouble shoot, isolate and repair defective units; and interpret and communicate technical information.

The co-ordinator will usually:

- Explain that most occupational areas have some 8 to 12 General Areas of Competence.

- Obtain from participants statements of General Areas of Competence. Each statement must contain a verb. Record each on a different card (about 15 cm by 12 cm coloured). Place them vertically on the right hand side of the board/wall.

- Seek to ensure a free flow of suggested General Areas of Competence.

- Seek to ensure that the listing is comprehensive; it is usually necessary to ensure that General Areas of Competence relating to attitudes (e.g. behaviours related to safe practices), to planning and problem-solving skills, to interpersonal skills, and to communication are considered for inclusion.

- Eliminate duplicates, by consensus.

- If more than 8 to 12 Areas have been suggested, use consensus techniques to reduce these to a workable number by combining some. (Each statement which is not selected as a General Area of Competence should be kept, and placed next to the General Area of Competence to which it is most closely related).

- Check, by consensus, that the wording is appropriate (the wording can be changed, by agreement, up till the end of the procedure).

4. Identification of the first band of competencies

Each competency is prefaced by: **"The person must be able to ..."**, followed by a simple action definition, always introduced by a verb. **It has been found that the flow of ideas should proceed as rapidly as possible;** any 'tightening up' of definitions can be done later (by adding more words, or by use of a rating scale).

The Co-ordinator does <u>not</u> suggest competencies.

The co-ordinator will usually:

- Select a General Area of Competence for which the listing of competencies appears straightforward (for example, psychomotor competencies rather than cognitive or affective).

- Obtain from the participants statements of competencies, in the form described above. Record each on a card (about 12 cm by 10 cm, white). Place them horizontally on the wall, adjacent to the specific General Area of Competence, going from right to left. <u>This step is undertaken as quickly as possible</u>. <u>Any apparent</u>

disagreements among the participants are postponed to Step 6. The co-ordinator should ensure that all participants are contributing. This activity should continue (for this band) without breaks.

- When the committee appears to have exhausted the competencies for that General Area of Competence, the co-ordinator asks: "Have we completed our task?", and seeks the agreement of the participants.

5. Identification of the remaining bands

The above process is continued for the remaining bands (i.e. General Areas of Competence). It is appropriate to insert a suddenly-remembered competency in a previously-completed band, but not appropriate to do so for a band not yet attempted.

The emphasis is on collecting competencies. It is initially less important to worry about the most appropriate General Area of Competence; competencies can be reallocated to a different General Area of Competence in Step 6.

Breaks (for morning tea, lunch, etc) should only occur immediately after the committee has exhausted the competencies for a specific band.

6. Review and refinement of the competency definitions

The co-ordinator will usually:

- Ask participants to consider whether there are any competencies which have not been included into any band; if yes, insert in an appropriate band, or define a new General Area of Competence.

- Determine, by consensus, whether any structural changes are appropriate (e.g. combining two bands).

- For each band, by consensus, refine as appropriate the statement of the General Area of Competence and of each competency. Any duplication is eliminated. **A statement is accepted by the committee when it is felt that most persons with an adequate background in the occupation would understand what is meant by the statement.**

7. Revision of list by job incumbents

This step is very necessary if the majority of DACUM participants were not job incumbents. It can be omitted, however, if the bulk of participants were job incumbents, and if the job incumbents actively participated. (This step is included because experience has found that managers and supervisors do not always know precisely what job incumbents do).

Select job incumbents who are representative of the branches of the occupational area.

Using the list of competencies from Step 6 above, ask these job incumbents to:

(i) Add competencies that are not on the list that are performed by them and their colleagues in the occupational area.

(ii) Indicate competencies on the list that are not performed by themselves or their colleagues in the specified occupational area.

N.B. Step 7(ii) is **NOT** necessary if Phase 3 data on extent of performance (e.g. frequency, relative time spent) are being obtained from many job incumbents.

At least 20 job incumbents are needed for Step 7(ii), to seek to ensure that competencies which are performed are not removed from the list of competencies. In general, some thoughtful analysis is required before a listed competency is removed.

8. Possible subsequent steps

Phase 2 of OA is the listing of competencies. If desired, the competency data could be detailed to provide Mager-style objectives. If desired, the competencies could be complemented by skill and knowledge data.

The 'pure' DACUM committee procedure goes through a series of additional steps: sequencing competencies, structuring and scanning the profile, and establishing levels of competence. This last step of obtaining additional data concerning the listing of competencies is discussed in Step 2.1a(ii) of Section B.

Findings

Finch and Crunkilton (1979) list the following:

- Relatively low development cost.
- The time frame for conducting the DACUM activity is quite short.
- "DACUM enables curriculum content to be derived without academic intervention" (p.119).
- The content is relevant.
- Instructors (teachers/trainers) should be observers, rather than participants, in the DACUM workshop.

Another very common finding is that there is frequently great difficulty in forming a DACUM group. Many employers are loath to allow employees a day off to attend a DACUM workshop (especially if the DACUM organizers do not pay the employers for the day).

This problem tends to be alleviated:

- if the DACUM group comprises a continuing Course Advisory Committee of committed members,
  or
- if the employer(s) support the OA, and can readily replace the employees attending the DACUM workshop.

References

Anderson, T. and Jones, N. 1986a.

Anderson, T. and Jones, N. 1986b.

Adaptations of DACUM

(i) Anderson and Jones (1986a)

Anderson and Jones list 3 modifications to DACUM. Most attention is given to the SKA (Skills/Knowledge/Attitudes) seminar.

(ii) Adapting for problems of a representative group meeting together

(a) Time constraints

A DACUM may take 1 or 2 days, which may be too long for some participants. The following procedure could be adopted.

- **Representative Group.** Undertake Steps 1, 2 and 3, i.e. up to the identification of the General Areas of Competence. This should take about 2 to 3 hours.

- **Either using subsets of the representative group or alternative representative groups.**

  Undertake Steps 4 and 5, i.e. identification of bands of competencies. Generally, about 3 bands can be developed in a 2 1/2 to 3 hour period.

- **Representative Group.**

  Undertake Step 6; i.e. review and refinement of the competency definitions. It could also be useful to obtain data on frequency and importance from the job incumbents/supervisors. It would be very useful to have teachers present at this session.

  This session should take less than 3 hours.

  The Representative Group could be the Course Advisory Committee.

(b) Constraints in "participants" meeting together

It is possible to adapt the above procedure to involve small groups of individuals or, if necessary, individuals.

- OA team meets 3 or 4 small groups of individuals, or if necessary, about 12 individuals, to obtain General Areas of Competence. These meetings will generally be at the place of employment of the 'participants' (job incumbents/supervisors).

The participants are selected as being representative of the occupational area.

The OA team synthesises information into a set of General Areas of Competence.

- OA team meets small groups of individuals or individuals to list the competencies for each band.
- OA team undertakes Step 6; i.e. review and refinement of the competency definitions in the competency profile.
- OA team meets small groups of individuals, or, if necessary, individuals, in order to 'validate' the competency profile and to amend as necessary.

D.5.4 NOMINAL GROUP TECHNIQUE

This technique is described in detail by Anderson and Jones (1986a). It is a very useful technique if conflict among participants is possible.

Phase 1: Nature and scope of the occupational area

It is considered that an adaptation of the Nominal Group Technique (NGT) is advisable to quickly obtain useable output. This adaptation consists of using the NGT for a set of three related questions.

Procedure

The facilitator initially discusses the three procedures to be undertaken.

Question 1 (Primary distinguishing function)

1.1 Facilitator presents the question:

"What is the primary distinguishing function which defines the occupational area of _____" (e.g. secretary; initial customer contact person).

The facilitator then adds:

"This primary distinguishing function should indicate the key differences between this occupation and other related occupations. Some examples of such a primary distinguishing function are: _____"

and presents appropriate examples.

E.G. secretary: provides support to an executive.

initial customer contact person:

initially receives guests/clients,
assesses their needs, and
undertakes relevant activities to address their needs.

The facilitator then invites questions, and attempts to ensure that the participants know exactly what is being sought.

1.2 Silent generation of idea in writing

Each participant writes down the primary distinguishing function of the occupational area.

1.3 Round-robin listing of idea

All participants present their idea, which the facilitator records on butcher paper (unless idea has been already presented by another participant).

1.4 Serial discussion of ideas for clarification

This allows each participant to explain the rationale for the primary distinguishing function he/she has presented if an explanation is requested by another participant or the facilitator.

1.5 Clustering of ideas

Similar (listed) ideas are merged together, with the agreement of the participants who proposed the ideas.

1.6 Preliminary vote of item importance

Each participant rates the three ideas considered most important in differentiating this occupation from other occupations, using the scale:

3 - most important
2 - next most important
1 - third most important.

1.7 Facilitator wording of primary distinguishing function.

Based on the vote of item importance, the facilitator develops the 'final' primary distinguishing function. This wording could combine all, or elements of, a number of ideas suggested by participants.

Agreement is reached that the wording of the primary distinguishing function is unambiguous.

Question 2 (Other key descriptors)

2.1 Facilitator presents the question:

"Given the primary distinguishing function, what key descriptors need to be added (if any) to differentiate the occupational area of _____ from related occupations"

"Write down a maximum of two ideas"

2.2 Silent generation of ideas in writing

2.3 Round-robin listing of ideas

2.4 Serial discussion of ideas for clarification

2.5 Clustering of ideas

2.6 Preliminary vote of item importance

2.7 Facilitator wording of key descriptors to be included in the written description of the occupational area.

Question 3 (Roles/functions not necessary)

3.1 Facilitator presents the question:

"Given the primary distinguishing function and the key descriptors developed to indicate the scope of the occupational area _____, what roles/functions should be excluded from the description (if any)"

"Some examples of such exclusions are: _____"

The facilitator then presents appropriate examples

E.G. initial customer contact person:

does not perform management or supervision functions; does not perform bookkeeping or accounting functions.

The facilitator then adds:

"Write down a maximum of two ideas"

3.2 to 3.7 These are parallel to steps 2.2 to 2.7.

3.8 Facilitator wording of the complete description of the occupational area.

3.9 A final check to ensure that the complete description adequately differentiates the occupational area from other related occupational areas, by asking the question (repeated as necessary):

"How does this description delineate a _____ (occupational area being considered) from a _____ (related occupational area)"

The description can be amended as necessary.

3.10 When this discussion is complete, there is a final check to seek to ensure that the description of the scope of the occupational area is unambiguous.

E.2 CRITICAL INCIDENT TECHNIQUE

Brief description

The critical incident technique was originally developed to try to determine why pilots crashed their planes. It has since been extended to other uses, including occupational analysis.

The outcome from this OA technique is a set of competencies that are 'critical' to effective performance in a defined occupational area. A critical incident could include the successful/unsuccessful treatment of a suicide attempt by a nurse or ambulance officer, the successful/unsuccessful adoption of new equipment in an office or factory, success/failure in obtaining a new contract, collapse of a building recently erected, collapse of a company recently audited, and so on. An incident is regarded as critical if:

(a) there is agreement that a specific outcome is a success or a failure

(b) there is a clear relationship between a subset of behaviours and the specific outcome in (a).

Critical incidents are described by job incumbents, and/or the supervisors of job incumbents using written statements, interviews, and/or questionnaires; and/or by trained observers watching job incumbents. From these incidents, competencies needed in the occupational area are inferred.

As implied above, there is an assumption that some competencies are critical, and some are not critical. Non-critical competencies are considered as those which do not relate to success or failure of specific job outcomes; however, if they are required by a job incumbent, they need to be obtained using another OA technique (such as DACUM).

Preparation before the collection of data

The first step is to prepare a written description of the occupational area, based on a Phase 1 analysis.

The next step is to undertake a series of pilot studies to determine:

- which group(s) of persons should be involved: job incumbents, supervisors, and/or one or more sets of trained observers (if possible, at least two of these groups should be used)
- which method(s) to use: written statement, oral statement, and/or questionnaire completion
- which timeframe(s) to use: prior incidents and/or concurrent incidents
- which wording to use when asking persons to describe critical incidents (examples are given on the next page).

Procedure

Phase 2. Competencies list

1. Specify methodology

The details of this step should be varied to meet the specific needs encountered in undertaking the pilot studies described above. For example, if job incumbents are unable to clearly write up the incidents, either oral statements could be taken from them, and/or proportionally more incidents be obtained from supervisors and/or observers.

About 100 to 200 critical incidents are typically recorded using this technique. The following table, which indicates percentages of critical incidents to be obtained for each cell, can be used as a starting point:

	Within last 6 months		Concurrent to study	
	Successful outcome	Unsuccessful outcome	Successful outcome	Unsuccessful outcome
Incumbent-written statement (and/or interview)	10%	10%	10%	10%
Supervisor-written statement	10%	10%	10%	10%
Observer-watching incumbents			10%	10%

Some examples of the wording which can be used when asking job incumbents to describe critical incidents are presented below, for (a) successful outcomes, and (b) unsuccessful outcomes.

(a) Successful outcomes

Think of some difficult or complex tasks (incidents) that you have handled successfully during the last 6 months. For each incident:

(i) Describe the incident, explaining why it was successful.
(ii) What did you do that led to effective job performance?
(iii) What training was of direct assistance?
(iv) What attitudes, values, knowledge, skills seemed to lead to success?

(b) Unsuccessful outcomes

Think of some difficult or complex tasks (incidents) that you have handled unsuccessfully during the last 6 months. For each incident:

(i) Describe the incident, explaining why it was unsuccessful.
(ii) What did you do that led to ineffective job performance?
(iii) What attitudes, values, knowledge, skills seemed to lead to unsuccessful performance?
(iv) What could have been done to lead to effective performance?
(v) Have you been in the same situation since? If yes,

- describe the incident
- if successful, describe what you did, and what training was of direct assistance in handling the situation.

As for each OA technique, it is necessary to ensure that the selected job incumbents (and/or their supervisors) are representative of the occupational area being studied (see Flow chart Step 1.2, Section B).

2. Train observers (if observations are being made)

Training given to observers would normally include:

- an explanation of the project aims
- assurance of anonymity of the observers and incumbents
- the definition of a critical incident
- the details of the project methodology
- assistance in developing sensitivity to job incumbents.

3. Collection of critical incidents

For an OA, some 100 to 200 critical incidents are typically collected.

4. Inference of competencies

For each critical incident, the competencies needed for successful performance are inferred from the data. This may be done in group sessions involving the project co-ordinator, observers, and job incumbents and/or supervisors. The author of each critical incident remains anonymous.

5. Identify the General Areas of Competence

The listed competencies are grouped into some 8 to 12 General Areas of Competence. Each group should be reasonably homogeneous, and is given an appropriate name.

All competency statements are assigned to a relevant General Area of Competence.

6. Refinement of the competency statements

Duplications of competency statements are eliminated. A statement is accepted when it is felt that most persons with an adequate background in the occupational area would understand what is meant by the statement.

Phase 3. Data on each competency

From Steps 5 and 6 above, it is a simple matter to count the frequency of occurrence of each competency statement.

If desired, each competency statement could be rated for degree of criticality.

Findings

Anderson and Jones (1986a) list the following:

- it provides a large amount of reliable and relevant information
- it provides information about refractory competencies which are difficult to obtain using most OA techniques
- it is relatively expensive
- it tends not to obtain information about routine job dimensions (and thus is normally used with other OA techniques, such as DACUM)
- observers need to be very sensitive, since job incumbents tend to dislike being observed, and since part of the method involves unsuccessful performance.

Reference

Anderson and Jones (1986a)

GLOSSARY

Behavioural objective (Mager-style)

An objective expressed in terms of the required observable behaviour (performance), criteria of acceptable performance (such as accuracy and/or speed required), and conditions (such as using a specified piece of equipment). Refer Mager (1962).

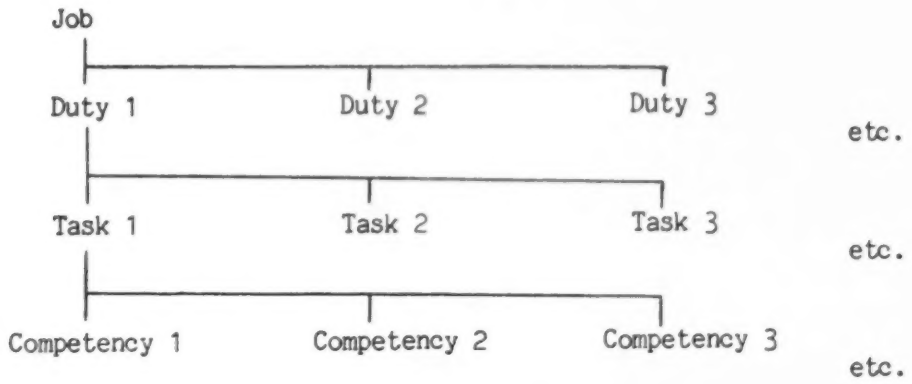
College

Used interchangeably with "education institution".

Competency

A performance capability needed by workers in an occupational area. Competencies may be cognitive, attitudinal, or psychomotor capabilities. E.g. Type at 30 words/minute for 15 minutes, with a maximum of two mistakes every 150 words.

Some authors suggest that a competency is simply a part of a task; e.g.



HOWEVER, in this manual, competency is used in a generic sense to **indicate that level of specificity which allows persons knowledgeable in the occupational area to communicate effectively with each other concerning occupational capabilities;** i.e. there is no ambiguity about the meaning of a competency statement. A competency may be very specific and include criteria for performance; or it may be a behaviour corresponding to a task, a skill, and/or knowledge.

In this manual, competencies are classified into two major groups: conventional competencies and refractory competencies.

In this manual, occupational competencies are being discussed; i.e. the performances expected on the job for the specified occupational area. (Compare teaching competencies).

Components of occupational courses

General studies; occupational studies A; theoretical base; practical component (to elucidate the relationship between theory and practice); skills development; general industrial experience (Hermann, 1987).

Conventional competencies

Competencies traditionally found by OA techniques:

(1) Psychomotor (e.g. cycling, sawing)
(2) Cognitive procedures (e.g. accounting procedures)

(Compare refractory competencies.)

Course

Used interchangeably with program.

Industry

A generic term which embraces all enterprises, public and private, including primary industry, commerce, and service industry.

Job incumbents

Persons working in the specified occupational area.

Mager-style objective (See Behavioural objective)

Occupational analysis (OA)

An OA is undertaken into an occupational area in order to provide data able to be used to develop a program to educate/train persons for that occupational area. Possible outcomes of an OA are listed on page 3. (ERIC uses the descriptor 'job analysis').

Occupational area

Used to refer to the scope of an occupational analysis. (See page 1).

Occupational education

Used interchangeably with 'vocational education'.

Parameter (as used in this manual)

A dimension which states the boundary of an occupational area.

Program

The aims/content/learning activities designed to lead to competence in the occupational area. Segments of a program could be: education institution, in-plant off-the-job, and/or in-plant on-the-job.

Refractory competencies

Competencies which tend to need more probing to detect in many occupational areas:

- Communication
- Interpersonal
- Management/supervision
- Planning
- High-level cognitive (problem-solving, analysing, synthesizing, evaluating)
- Safety
- Attitude-related

Such competencies may be grouped in various ways; e.g. with respect to performance, to management, and to the role/job environment (compare conventional competencies).

Skills

Learned competencies to perform a task or activity in an organized and co-ordinated way. Skills are perceptual-motor, intellectual, social, affective, etc., depending on the primary nature of the activity and the responses required.

Tasks

Tasks are major elements of work which achieve specified results. (Note: A task, such as making a table with a glass top, encompasses a range of skills, such as measuring, sawing, planing, etc. Most occupational curricula are based on learning skills; thus occupational analysis (OA) data based on 'tasks' may need refinement to translate them into 'skills'.)

Teaching competency (college competency)

A teaching competency has less stringent criteria than the corresponding occupational competency; it is assumed that attainment of the teaching competency plus additional on-the-job experience will lead to attainment of the occupational competency.

Theoretical base

An understanding of the concepts, principles and rationales for given phenomena, properties of materials, and operations (such as performing a task in a specific way), which inter alia allows more readily for problem solving and for transfer of learning to a new situation.

(NOTE: Aspects of 'theory' may be taught:

(a) because the content is actually used in the occupation (i.e. as terminal objectives);

(b) because the content enables the learner to learn content used in the occupation (i.e. as enabling objectives);

(c) because the content provides a framework for such cognitive objectives as application, analysis, synthesis and evaluation needed in the occupation.

Only (a) can be directly determined in an occupational analysis.)

Trendsetter

Indicates an enterprise which tends to be an early adopter of new technology/material/etc.; it is also used to refer to an expert (such as a technical manager) in such an enterprise.

Vocation

Used interchangeably with 'occupation'.

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